THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. MAY 14, 1896. CHICAGO, ILL. NUMBER 20.

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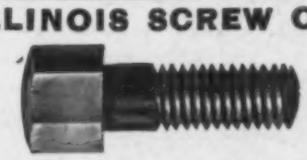

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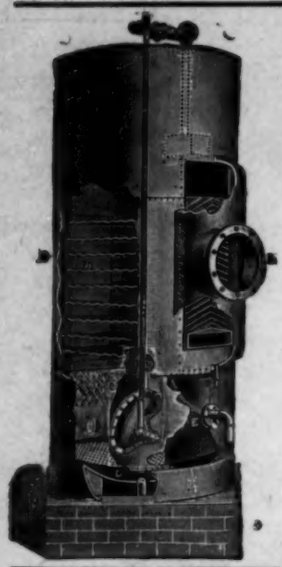

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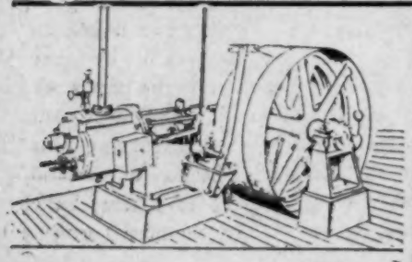

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THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. MAY 14, 1896. CHICAGO, ILL. NUMBER 20.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

There are some signs of the curtailment movement of which the iron trade has stood in need for many weeks. A number of blast furnaces have gone out in the past three or four weeks and here and there a rolling mill has shut down in most or all departments. If labor demands upon Western mills are according to the programme announced there may be a further restriction of production before the opening of the third quarter. The wage scale adjustment finds the manufacturers in a different condition from that which attended the conference of last year. Then the mills had begun to feel the impulse of reviving demand and were anxious to keep going. To-day most of them are uuable to tell at the end of a given week what their running schedule will be in the week to follow. The proposition agitated among some Amalgamated Association lodges for an inflexible rate, based on a card minimum above any market price yet touched is not likely therefore to be acceptable to employers. The question of uppermost concern to billet-buying mills continues to be the practical working out of the billet pool programme. The rumors of negotiations by large works, for the allotments of smaller members of the pool, continue to circulate; and while it is affirmed with some emphasis that the Ohio Steel Co.'s plant at Youngstown will not be shut down, as the result of any arrangement, report is busy as to other works of less importance—all to the purport that unless demand expands materially the business done in the life of the pool will be centered in few hands. Open-hearth engineers are busy, meantime, on estimates, not only for tin-plate plants, but for merchant mills, and no less than a half dozen concerns in the Central West are now making plans in this direction, some of which may be expected to have a tangible outcome. Another influence, of slower operation, that bears also toward an increase of the open-hearth product, is the lowering of the average phosphorus content of Bessemer steel and the resulting enhanced cost of the limited supply of native low-phosphorus ores. One week's events, in a drifting period like the present, are scarcely significant, and the week under review has brought few changes. The 5,000-car order of the B. & O., on which the bar iron trade has had its eyes for several weeks, has been placed, Central Western shops getting the bulk of it. Some structural work has come up—2,500 tons for the Girard estate at Philadelphia, and a good bridge tonnage at Pittsburg, while Chicago reports specifications coming better on contracts. Prices are maintained, for the most part, with some shading on angles and plates, the bulk of the going business being small lots, on which there is no object in cutting. Bessemer pig is weak at $12.75 to $13 Pittsburg, and a sale has been made at $12.55, equivalent to $11.80 in the valley. Billets range from $19.50 to $19.95, Pittsburg, on sales through middlemen. For later delivery a few lots are reported sold at the pool price.

THE CLEVELAND DISTRICT.

Ore-buying shows something of a lull, after three weeks of activity. The Pittsburg district has not been largely represented in the market thus far. It is expected, that as in other years, the pace will be set by the leading interest, but it is a question whether Pittsburg furnaces generally are as well supplied with old ore as are those of the Carnegie Steel Co. Ores whose phosphorus is in the neighborhood of .04 and .045 promise to be well taken up in the next buying movement of Bessemers, in view of the scarcity of ores of lowest phosphorus content. Thus far little or no ore has been sold for Eastern shipment. Last year, owing to exceedingly light receipts of foreign ores, furnaces in eastern districts drew upon Lake Superior to a larger extent than in several years. In the past winter imports have been of considerable volume. In the nine months ending March 31, 607,186 tons had been received at Eastern ports against 175,316 tons in the nine months ending March 31, 1895. While local sales agents have done little thus far in non-Bessemer ores, the prices named range from $3 to $3.25 for hard non-Bessemers, while No. 1 soft ores are quoted at $2.75 to $2.90. Mesabi non-Bessemers that might enter a Bessemer mixture, brought $1.85 to $1.95 last year; the quotation this year is $2.60 to $2.70. The firmness of lake freights and the increased cost of labor at the mines seem to be holding the lines on foundry ores, without an agreement. In the case of old-range mines production of non-Bessemer grades has been limited. Another element that may be to the advantage of non-Bessemer properties is the possibility of a larger use of iron, now that the price of steel is held up by agreement. Lake freights have been stationary the past week. The wild rate from Escanaba is maintained at 70 cents and from the head of the lake $1 is paid. Gogebic shipments are being made almost entirely by way of Ashland, the advance in the Escanaba vessel rate temporarily changing the plans of shippers who contemplated sending a considerable tonnage that way.

Pig Iron. Two valley furnaces, Mary at Lowellville, and Mattie at Girard, are about to be relined and in Cleveland, Central furnaces are still inactive. Naturally pig iron stocks in the valleys increased in April but there has been a conservatism in Bessemer production since the opening of the year and foundry and forge irons promise to be a larger percentage of the output than they were last year. Actual sales have been small the past week, but Bessemer for prompt delivery is weaker. A sale at $12.65 Pittsburg, or $11.90 in the valley is reported; but there is no selling for delivery in the third quarter on such a basis. Foundry iron is moving only in a car-lot way. Pipe foundries are running quite full, and foundries having contracts for special light castings are occupied, but jobbing and heavy machinery run with more or less irregularity. We quote Cleveland prices: $12.50 to $12.75 for No. 1, and $12 to $12.25 for No. 2. Lake Superior charcoal has had a fair spring demand and $13.50 is still the usual price, though an advance to $14 is reported on one brand that is well sold up.

Finished Material. A slightly better feeling is noted in some parts of the local market, but with no quotable change in price. There is no large business, and quick delivery is desired on most orders.

Continued on page 7.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1142 MONADNOCK BLOCK, May 13

The market has been exceedingly quiet in the past week. In no branch of the iron business have any large transactions taken place and the size and number of inquiries received denote no large increase in business in the near future. The only information of any particular importance is the announcement of the placing of the contract for the 5,000 cars the B. & O. receivers were to buy. Of these 5,000 cars 1,000 were placed with the South Baltimore Car Works, and the remaining 4,000 were divided among Central Western and Western car builders. The Pullman Car Co., which rolls its own bars, got 1,000 cars. Orders for the rolled iron for the other 4,000 cars will probably be forthcoming in the near future. The general run of buyers seem inclined to wait until after the June convention before placing any large orders. It is possible that after the St. Louis declaration has been made, business will be improved, but there is still the liability that buyers may postpone large purchases through the campaign.

PIG IRON.—Very little business was done last week in either Northern or Southern iron. Yet prices of both classes of iron are being very well maintained by the furnaces. There is a possibility that if the wait continues much longer, quotations, particularly those of Southern iron, may be forced down. There is very little inquiry for any class of pig iron in the market at the present time and none for anything like large lots. Some of the Southern furnaces report that their customers are requesting that deliveries be held up. Lake Superior charcoal is in moderate demand, though one important producer is reported well sold ahead, and prices are maintained firmly. Quotations are now made as follows:

Lake Sup. Charcoal	$13 50@14 00	Southern No. 2 Soft	$11 35@11 60
Local Coke Fdy. No. 1	12 25@12 50	South'n Silveries No. 1	11 85@12 35
Local Coke Fdy. No. 2	11 75@12 00	South'n Silveries No. 2	11 60@11 85
Local Coke Fdy. No. 3	11 00@11 50	Jackson Co. Silveries	14 50@16 00
Local Scotch Fdy. No. 1	12 25@12 50	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2	11 75@12 00	Ohio Silveries No. 2	14 50@15 00
Local Scotch Fdy. No. 3	11 00@11 50	Ohio Strong Softeners	15 00@15 50
South'n Coke No. 1	12 10@12 35	Alabama Car Wheel	16 85@17 35
South'n Coke No. 2	11 60@11 85	Malleable Bessemer	13 25@13 50
South'n Coke No. 3	11 10@11 60	Coke Bessemer	13 50@14 00
Southern No. 1 Soft	11 60@11 85		

BARS.—Several of the large agricultural implement manufacturers purchased round lots of steel bars last week and other inquiries are in hand. The bars for the B. & O. cars will undoubtedly be placed in the near future. General business has been quiet and no increase in sales is expected in the immediate future. The Springfield mill shut down several days ago because of the company's dissatisfaction with current prices. It is not known how long the mill will be out but it will hardly be put in operation again until prices are higher. Quotations are unchanged as follows: Common iron, 1.30c to 1.35c; guaranteed, 1.35c to 1.40c; soft steel bars from strictly billet stock, 1.40c to 1.45c.

RAILS AND TRACK SUPPLIES.—Local mills report a fairly good business in small lots. No especially large contracts have been placed or are in view. Quotations are as follows: Rails, $29; splice bars, 1.40c to 1.45c; track bolts with square nuts, 2.15c to 2.25c; hexagon nuts, 2.40c to 2.45c; spikes, 1.70c to 1.75c.

BILLETS AND RODS.—No sales of either billets or rods were made in this market last week, and while there is some inquiry in hand it is not expected any large business will be done until after the first of the month. Quotations are unchanged at $21.25 for billets and $29.50 for rods.

STRUCTURAL MATERIAL.—The only encouraging feature is the fact that specifications on old contracts are coming forward very freely. One order of 300 tons of material for the drainage canal was placed last week. Prices are unchanged, as follows: Beams and channels, 1.65c to 1.70c; angles, 1.45c to 1.50c; plates, 1.50c to 1.55c; tees, 1.65c to 1.70c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—Orders of from 50 to 200 tons have been fairly frequent, and there is a good prospect for a continuance of this class of trade. One inquiry was received for 1,000 tons and several others for round lots have been on the market for some time but have not yet been placed. Quotations are unchanged as follows: Tank steel, 1.50c to 1.55c; flange steel, 1.75c to 1.80c; fire-box steel 2.35c to 5c; boiler tubes, 65 and 10 to 70 and 10 per cent discount.

SHEETS.—Both black and galvanized sheets are in fairly good demand and quotations are being maintained very firmly. No. 27 black sheets are quoted at 2 30c to 2.35c. Galvanized sheets are selling at 75 and 10 and 5 per cent discount.

MERCHANT STEEL.—A slightly better inquiry is had and implement manufacturers have placed several round lots in the past week. Quotations are unchanged, as follows: Open-hearth spring, tire and machinery steel, 1.85c to 1.95c; smooth finished machinery steel, 1.65c to 1.70c; smooth finished tire 1.60c to 1.65c; tool steel, 5 50c to 7.50c; specials, 11c and upwards; Bessemer bars, 1.55c to 1.65c.

OLD RAILS AND WHEELS.—The market is very dull and only a few small sales are reported. The outlook for the immediate future is not at all bright. Quotations are nominally as follows: Old iron rails, $15 50 to $16; old wheels, $13.50 to $14; old steel rails, $11 to $11.50.

SCRAP.—Call for old material is very small and dealers report very few transactions closed. It is hardly expected there will be any increase in business in the next few weeks. The following are buying quotations furnished by dealers: Railroad forge, $13 to $13.50; dealers' forge, $11 to $11.50; No. 1 mill, $8.25 to $8.50; heavy cast, gross ton, $10; malleable cast, $11.00 to $11.50; axles, $15; cast borings, $5.00; wrought turnings, $6.50; axle turnings, $7.25; mixed steel, $8 to $9; stove plates, $7; heavy melting steel, $10.50 to $11.00.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
807 TRADESMEN'S BUILDING, May 13.

There is as yet no break in the dull monotony that has characterized business here for some weeks past. Every one seems content to wait and it can safely be said that the few buyers of the past week have been forced to go into the market to supply immediate needs. Sales are of too rare occurrence to establish prices and the lack of inquiry renders quotations useless. Bessemer pig has, if possible, been weaker and prices have declined. We note one sale of 5,000 tons at $12 in the valley or $12.75 Pittsburg. Another sale is reported at $11.90 valley furnace. Smaller transactions are at $13 Pittsburg, although quotations reach $13.25. Gray forge is quoted at $10.90 and $11, though no sales are reported. On foundry $12.50 to $12.75 for No. 1 and $12 to $12.25 for No. 2 are quoted. Billets remain about as quoted last week—$19.50 and $19 65, though the larger mills report a few sales at the pool rate. Quotations by brokers have gone as much as $1 below the $20.25 basis. Continued rumors of the closing down of small mills produce uncertainty, but have little effect on the market, as there is nothing imminent. The supply of outside steel is being gradually reduced but consumption is comparatively

so slight that middlemen are still quite a factor, and their declarations that they will continue to be sellers of steel under the pool is having some influence on sellers. Inquiry for finished product shows an increase over last week, and some of the mills report that they are fairly filled with orders for the immediate future. Beams and channels are maintained at 1.45c., plates at 1.30c., and angles are quoted 1.25c to 1.30c, with a tendency to weakness. The P. & L. E. Railroad will double track the viaduct approaching its bridge over the Monongahela, south of Rankin Station. The additional viaduct construction involves about 650 tons of material. The contract has been awarded to the Keystone Bridge Co. Steel bars are quoted 1.15c to 1.20c. A sale of 600 tons at the former price is reported. Rails are quiet, but the local mill has a good tonnage booked. The demand for wrought pipe is not what was to be expected from the month, yet it is believed considerable business is in abeyance, that will come up in a short time. Discounts are nnchanged, as follows: Black pipe, 1¼-inch and smaller, 57 four 10s and 5 per cent; on 1½-inch and larger, 67 and four 10s; galvanized 1¼-inch and smaller, 52 and four 10s and 5 per cent; on 1½-inch and larger, 57 and four 10s; boiler tubes, 70 and 10 per cent. The above rates are for car lots. The market for sheets is unchanged. Sales are for short deliveries and July 1 is the limit on most transactions. We quote 2.10@2.15c for No. 26, 2.20c@2.25c for No. 27 and 2.30@2 35c for No. 28. Sheet bars are $23.50 to $23. Old material shares the general inactivity. Heavy melting stock is quoted from $14 to $14.50 gross ton; light steel at $12 gross; old iron rails at $16.50, steel rails, $13.50 to $13.75; old car-wheels, $12 gross. The production of Connellsville coke continues restricted. In the week ending May 2 there were 11,417 active ovens, with an output of 117,260 tons, an increase of about 1,400 tons over the preceding week. Shipments were 6,641 cars, a slight decrease from the previous week.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Cincinnati. Conflicting reports are received regarding the relative consumption of iron compared with one year ago. To ascertain as nearly as possible the true condition of affairs, Rogers, Brown & Co. have had made in various sections a careful canvass of representative foundries. The following analysis of the business of 20 foundries in one of the largest Ohio manufacturing centers, represents quite fairly other cities in the state. Two report melting twice as much iron during the first quarter of 1896 as same period of 1895. One reports 50 per cent more, two 33 per cent more, five about the same amount, six 33 per cent less and four 50 per cent less. In Central and Western New York about 25 per cent increase is reported in one city, about 33 per cent in another, and two others report practically the same as last year. It will be remembered that January and February, 1895, were months of unusual dullness. Little interest is manifested by consumers, and most of the Southern furnace companies are quietly sending forward shipments on old orders, and not trying to force sales. Birmingham furnaces make Cincinnati quotations of $11 on No. 1 Foundry, $10.50 on No. 2 foundry and No. 1 soft, and $9.50 on gray forge; Tennessee charcoal is quoted $13 and $13.50, and Lake Superior charcoal $15 to $15.25.

Philadelphia Quietness prevails. No large orders to report, the buying having been confined to the rank and file of small consumers. Some of the rolling mills in the Harrisburg district have bought 300, 400 and 500 ton lots special strong irons to fill out their mixture for the next 60 days. Steel remains firm, and no change is noted in Connellsville coke. Lake Superior charcoal iron—standard brands such as Hinkle, have marked prices up 50 cents.

St. Louis. There has been very little active interest shown in the iron market the past week. Consumers seem content to wait until in actual need of iron, or until there is an improvement in the general condition of trade. Notwithstanding the extreme dullness there is no indication of lower prices, which is an encouraging feature.

Buffalo. The week just passed has shown considerable activity in Lake Superior charcoal iron. Several good sized orders have been placed by the larger consumers for their season's requirements of that class of iron. These sales have been followed by an advance of 50 cents per ton made by the leading Lake Superior charcoal furnace. Outside of charcoal iron, however, the market has been quiet and uneventful. Foundries are fairly busy, and those running on specialties are quite full of work. We continue to quote No. 1 strong foundry iron, Lake Superior ores, at $13@13.25; No. 2, $12.50 @ $12.75; Ohio strong softener No. 1, $13@$13.50; Jackson County silvery, $15.25; Lake Superior charcoal, $13.50@$14; Southern soft No. 1, 12.40: Hanging Rock charcoal, $17.

Western Foundrymen's Association.

The next meeting of the Western Foundrymen's Association will take place at the Great Northern Hotel, Chicago, at 7:30 p. m., Wednesday, May 20. The following questions (Topical Questions Nos. 6 to 10) will be discussed in their order, or as many as can be reached:

6. In your experience, what is the most efficient method of cleaning light castings?

7. What is the proper temperature at which to bake cores? What method do you use for determining this temperature?

8. What is the proper amount of air, and pressure of same, to melt iron in a cupola, and what are the effects of too little and too much air?

9. Is it economical to ventilate a foundry artificially? What has been your experience?

10. What is the best method of lighting a foundry of modern design?

Foundrymen are requested to submit information or a discussion on any of these questions.

The election of officers will take place, this being the annual meeting of the association and its third anniversary.

Personal.

Mr. F. E. House, for many years past chief engineer of the P. & L. E. Ry., has accepted a similar position with the New Butler & Pittsburg Railway.

Mr. Andrew Carnegie is in Pittsburg this week on business connected with the New Butler & Pittsburg Ry. He sails for Europe on the 16th.

Death of Thomas Seddon.

Thomas Seddon, president of the Sloss Iron & Steel Co., died at Birmingham, Ala., May 10, of Bright's disease, aged 47. Mr. Seddon was a son of James Alexander Seddon, of Virginia, Secretary of War of the Confederate States. He was born poor and was at a disadvantage owing to a physical handicap, but he accumulated a large fortune and was an influential factor in the development of the iron resources of Alabama.

A CHARTER has been issued to the Ft. Pitt Bridge Works Co., of Pittsburg, for the manufacture of architectural, structural and ornamental iron and steel; capital, $100,000. Directors, William Eberhardt, Gottlieb Dellenbach, George Washington Eberhardt, Allegheny City; Theodore Alfred Straub, Herman Rowner Blickle, Pittsburg.

THE IRON TRADE REVIEW

DEVOTED TO IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES.

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ENTERED AT THE POST OFFICE IN CLEVELAND, O., AS SECOND CLASS MATTER

MAY 14, 1896.

INVESTIGATING OUTER MARKETS.

The National Association of Manufacturers has been answering, in the past two or three months, some of the criticisms on its inactivity that were passed just after the Chicago convention. It has demonstrated, even in this short interval that its plans for the enlargement of the markets of American manufacturers are not paper plans. President Search has been vigorously at work, not only in informing the business world as to the objects of the association—and ignorance on this point is the chief explanation of the criticisms that have been heard—but also in setting in motion inquiries that will be of great practical value. A short time ago a special delegation was sent out to report on industrial conditions in Japan and as to the industrial lines in which this country might expect competition from that quarter. This inquiry was put in the hands of Robert P. Porter, whose equipment for the work is conceded to be ample. Later a special deputation, including Messrs. Davis and McGowan, the well known Cincinnati manufacturers, and Manager T. A. Martin, of *Dixie*, was sent to Mexico to confer with President Diaz concerning the participation of the manufacturers of the United States in the exposition to be held at the City of Mexico next year. Incidentally these gentlemen were asked to make some investigations into commercial and industrial conditions in Mexico with a view to furthering our trade with that country.

A later circular of information, issued by the association's bureau of publicity, notes that as another practical step toward the establishment of more intimate trade relations between the United States and the South American countries, a party of representative business men will be organized, to visit the Argentine Republic, the Republic of Uruguay and the United States of Brazil. Invitations have come from the governments of these countries and the delegation will be their guests. The start from New York will be made July 1 and the trip will be by way of Southampton.

We shall be disappointed if this trip does not result in adding further cogent reasons for the restoration of the policy under which the United States made distinct progress in the extension of trade to the southward. Reciprocity at this stage in the industrial development of the United States, is but a natural outgrowth of the policy of protection. It has been the lament of British statesmen on more than one occasion, that the established policy of the United Kingdom had left it without any trading capital in the international struggle for outer markets. Access to British ports being free to every nation, there was nothing that could be used in bartering for special commercial favors in other countries. The United States, with her protective duties, holds her markets as a prize for which other nations are glad to bid. Judicious bargains must be made, to be sure, and reciprocity should never be used to the subversion of the protective policy, but rather to its amplification. For when an outer market is guaranteed to our manufacturers, as against foreign rivals, they have been virtually protected there as they are at home. And the concession given in return, if properly guarded either by bounty or by the selection of products on which the duties have more of a revenue than of a protective character, would not unfavorably affect the manufacturer at home.

EXPORT MACHINERY TRADE.

There is a steady, if not rapid, increase in the exports of American machinery. The Treasury Department statistics for the nine months ending March 31 show that machinery valued at $12,897,897 was shipped from the United States for foreign countries in that period, as compared $11,209,428 worth in the corresponding period of the preceding fiscal year. The most noteworthy increase is in exports to the United Kingdom and other European countries. To the United Kingdom, machinery valued at $2,469,647 was shipped in the period named, against $1,736,024 in the nine months ending March 31, 1895; to Germany, the amount was $710,233, against $351,133; to France, $304,448, against $242,021; to "Other Europe," $1,610,703, against $538,472. Adding all up, and the total is $5,095,031, as against $2,867,650 in the corresponding nine months of the previous year, or an increase in machinery shipments to European countries of nearly 80 per cent. Another conspicuous increase was in the case of Mexico, the totals for the two periods being $1,757,971 and $1,278,076, respectively. African shipments, chiefly for mining operations, increased from $568,418 to $876,921. Cuba and Brazil fell away, the former from $1,570,684 to $324,277, and the latter from $1,778,413 to $908,799. Reciprocity abolition is plainly in evidence in these figures.

The export showing for all forms of iron and steel and their manufactures is gratifying. Some of the comparisons are as follows:

	9 Months ending March 31, 1895.	9 Months ending March 31, 1896.
Pig iron, bars, castings, cuttlery, etc	$1,454,057	$1,937,795
Builders' hardware and saws and tools	3,262,753	3,898,976
Machinery, n. e. s.	8,602,446	10,492,510
Fire engines	9,010	6,845
Locomotive engines	3,120,182	1,826,948
Stationary engines	175,325	159,422
Boilers and parts of engines	302,465	412,172
Printing presses	114,268	292,094
Nails and spikes	364,937	493,620
Plates and sheets	91,640	64,632
Rails	240,304	235,104
Scales and balances	217,911	314,496
Sewing machines and parts of	1,473,632	2,270,272
Stoves and ranges	178,999	239,979
Wire	931,035	1,095,495
Other manufactures of iron and steel	3,985,654	5,359,721
	$23,564,618	$29,100,081

THE CENTRAL WEST FOR MACHINE SHOPS.

There are three classes of manufacturers and machine builders in the East: Those who think there is no place but the East, those who wish their business was in the West, and those who are going west at the first opportu-

nity. Of the first class there are two divisions: First, those who have never been west, know nothing whatever about the West, and say, practically (as one of this class recently said to me), "It's no use talking; if you want *good work* you *must* come to the East for it." The second division consists of those who have been west with the idea that "simply coming from the East will make a man a lieutenant general in the West" (with apologies to "Chordal"); and having found out their error, have returned to the East, and get what satisfaction they can from disparaging the West.

There can be no doubt that the Central West is the present proper place in which to do a manufacturing or machine building business, and the reason is easily seen: In the first place it is now thickly settled enough to make a good home market for itself; second, the raw materials are right at hand, and the difference between shipping iron and steel east, and shipping the finished machine back again, is in many cases a profit in itself. It follows, then, raw materials being at hand, that the Central West can not only compete in its own limits, but outside as well.

This being a well-known fact, the result has been to attract a large number of the third class mentioned above, who have, as soon as opportunity presented itself, "pulled up stakes," in the East, and settled in the Central West. Of course every course of this kind adds to the strength of the Central West. I have in mind one enterprising firm who jumped from the East to the West, but jumped a little too far, and discovering their mistake, jumped back half way again, and have for a number of years been in the Central West, where they are perfectly satisfied. And I can say positively that this particular concern is doing as good work as its Eastern competitors, and is making it pretty lively for some of them too.

The second class mentioned above, has quite a large membership, and it is this class that is feeling the competition of the Central West the most keenly, but their case is not as hopeless as that of the first class, who are well represented by the man who ran a small jobbing shop, but who didn't want to hire any help, because he "could do all that *came in*" himself. SCRUTATOR.

FROM the Treasury Department statistics we compile the following statement of imports of iron and steel into the United States in March and the nine months ending March 31, 1896, as compared with like periods in the preceding year:

IRON AND STEEL IMPORTS TO UNITED STATES IN MARCH 1895-96 AND IN NINE MONTHS ENDING MARCH 31, 1895-96—GROSS TONS.

	March.		Nine months ending March.	
	1895.	1896.	1895.	1896.
Pig iron	1,373	6,795	11,271	68,213
Scrap iron and steel	52	433	1,853	7,055
Bar iron	439	861	10,406	18,457
Rails	3	86	315	1,056
Hoops and bands	.....	.....	173	15
Ingots, blooms, etc	977	2,168	9,395	25,033
Sheets and plates	1,828	611	23,506	8,216
Cotton ties	.....	.....	5	3,485
Tin plates	25,033	8,220	173,996	140,840
Wire rods	2,060	1,765	18,446	21,725
Wire, etc	471	479	3,654	3,766
	32,236	21,418	253,050	297,861

THE CLEVELAND DISTRICT.—Continued from Page 3.

Mills in the Mahoning valley are running fairly full this week, but have little booked ahead. The status for valley mills when the pool price for steel becomes operative is a matter of not a little speculation; it is to be expected that puddle mills will be a larger factor if a conservative course is followed by the Bar Iron Association. Present demand for bars, iron and steel, is limited, though some business is looked for on car account. We make no change in quotations: Beams and channels, 1.54c; angles, 1.34c; steel bars, 1.24c; bar iron, 1.20c in car lots; sheets, 2.30c for No. 27 common, and for galvanized 75 and 10 per cent discount. Chains are the latest product to be advanced by agreement, the new basis having taken effect the past week.

NATIONAL CONVENTION OF FOUNDRYMEN.

By Telegraph to *The Iron Trade Review*:

PHILADELPHIA, May 13.—The first National Convention of Foundrymen o the United States is a success. There are 280 foundrymen here, a majority of them coming from east of the Alleghenies, but the Central West is well represented and there are foundrymen from the far West and Northwest, as well as the Dominion of Canada. The sessions are held in the Franklin Institute. Mayor Warwick of this city, delivered the welcoming address at the initial meeting, Tuesday afternoon, and there was an address also by President Search, of the National Manufacturers' Association. President Francis Schumann, of the Foundrymen's Association, in stating the object of the meeting, said that the 4,000 foundries of the United States represent a capital of $115,000,000, and employ 120,000 men. At the evening session, Alex. E. Outerbridge read a paper, illustrated with lantern slides, on foundry cranes and different methods of driving them, and C. W. Shields presented a paper on "Air Compressors for Use in the Foundry." At to-day's meeting, Charles James and W. C. Henderson, of Philadelphia, gave a demonstration of the method of making analysis of pig iron, using laboratory as apparatus. This was very successfully carried through and was warmly commended. Papers were read by Thos. D. West, D. J. Matlock, W. J. Keep and Harris Tabor. At the afternoon session the American Foundrymen's Association was organized and a constitution adopted as reported by a committee consisting of A. Sorge, Jr., Chicago; Wm. Taylor, Pittsburg; M. Magee, Boston; J. Best, Montreal, C. S. Bell, Hillsboro, O.

The new organization will be like those now in existence in devoting itself to investigations and the improvement of foundry practice. It will not displace them, its meetings coming but once a year. Its secretary will probably be a salaried officer. There is much interest in the work of the convention and the hospitality of the Philadelphia foundrymen is lavish. A. I. FINDLEY.

The B. & O. Car Order Let.

Contracts for the construction of 5,000 new freight cars were awarded May 9 by General Manager Green, of the Baltimore & Ohio Railroad. The successful bidders are: Pullman Palace Car Co., of Chicago, 1,000; Barney Smith Car Co., of Dayton, 800; Missouri Car & Foundry Co., of St. Louis, 900; Michigan Peninsula Car Co., of Detroit, 800; Mount Vernon Car Co., of Mount Vernon, Ill., 500; South Baltimore Car Works, 1,000. The aggregate cost of the new cars will be nearly 2,500,000. The contract is one of the largest ever given for equipment in the United States. Payment will be made through an issue of receiver's certificates.

THE following papers were read at the annual meeting and conference of the British Iron Trade Association Wednesday, May 6: By Mr. W. Jacks, M. P., on "The Conditions of the Manufacture of Iron and Steel on the Continent." By Mr. Jeremiah Head on "The Conditions under which Alabama Pig Iron is made and Imported into Europeon Countries." By Sir Benjamin Hingley, bart., on "Conciliation and Arbitration in the South Staffordshire Iron Trade." By Secretary Jeans, "Twenty Years of Imports and Exports of Iron and Steel."

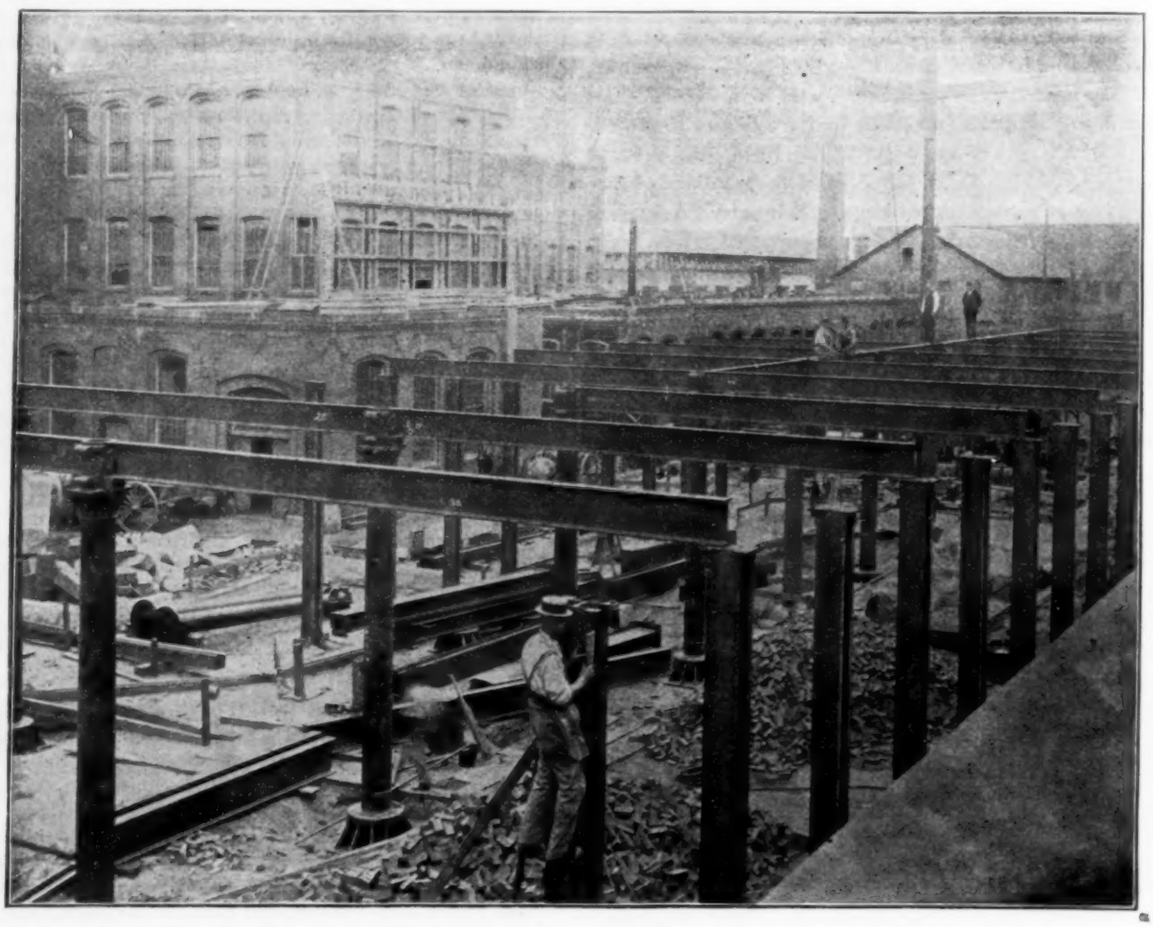
THE tin plate manufacturers will meet in Pittsburg May 15 to hear the report of the committeee appointed at their meeting one month ago to investigate the probable effect of the billett pool, and suggest a course of action for the tin plate plants.

G. B. BOOTH, son of Lloyd Booth, president of the Lloyd Booth Co., Youngstown, O., died May 6. He was connected with the Falcon Bronze Co., organized at Youngstown, a short time ago.

MODERN SHOP BUILDING.

The Brown & Sharpe Mfg. Co., of Providence, R. I., has exemplified in many features of the recently completed extension of its No. 1 building the most approved methods of modern shop construction. More than ordinary interest attaches, therefore, to the views and description of the new building, as presented in a recent publication of the company, from which we take the following:

The new building is in the rear of the No. 1 building, and conforms to it in architectural style. It has four stories, and is connected on two of them, through wings, with the No. 1 building, and with this forms a hollow square. The principal dimensions are as follows: Parallel with the No. 1 building, the new building is 163 feet by 51 feet, and the east and west wings are, respectively, 73 by 51 feet, and 50 feet by 43 feet, making, as each floor has the same dimensions, a total area of about 50,000 square feet. In addition there are staircase and elevator towers. The first story is 16 feet 10 inches high, and the others are each 13 feet 1 inch in the clear.



The foundations (Figs. 1, 2 and 3) rest upon piles, arranged to secure a uniform distribution of the load, of not more than 25,000 pounds per pile (Fig. 1). The piles are cut off below the water level, but instead of being capped with timber in the uaual manner, they are surrounded with a bed of cement concrete, six feet wide, brought flush with, and entirely enclosing the heads. The footing stones are six feet by four feet by one foot six inches, dressed to a true bearing on the heads of the piles, and bedded in the cement concrete. On top of this footing, and up to the level of the brick walls, there is a wall of large building stone, three feet six inches thick. This wall is about nine feet deep from top of piles.

In the centre of the building the foundation is built in the same manner to a height of four feet, when battered granite piers 12 feet long are constructed. On top of these piers are placed granite capstones, five feet by three feet six inches by one foot six inches thick; upon these rest the cast iron column bases (Figs. 1, 2, 3).

Above the foundation the construction is of the well known steel frame type. The columns are made up of steel Z sections riveted to the central plate—for the first floor, 10 inches by 7-16 inches, weighing 75 pounds per foot; for the second and third stories, 10 inches by 5-16 inches, 54 pounds per foot; and for the fourth floor, eight inches by ¼ inch, 38 pounds per foot.

The walls are 24 inches thick through the pilasters, including the Z bar columns and ventilating flues. Only a few more bricks are required for this construction than would be necessary for a 12-inch solid wall, while the supporting power is equal to that of a solid 36-inch wall.

The walls are also provided with ventilating flues (Fig. 5), two to each pilaster (one on each side of the two Z beam columns), made of special shaped fire-clay flue lining, and connecting with each room near the floors and ceilings by means of registers. These flues have a sectional area somewhat greater than an 8-inch circular flue, and are specially designed to assist in the proper distribution of the hot air supply, by means of the registers. The tops of the flues are offset to clear the granite coping, and are closed by a marble slab two inches thick, set at a slight angle to drain the water from the coping on to the roof proper.

The floors, roof and coping also present some interesting features. The roof-beams are 12-inch I beams, placed four feet between centers, and correspond in position to the floor-beams below. They support porous terra cotta arches, formed of special shaped tiles to make the top surface flat and the under surface arched. Similar arches of brick form the ceiling of the floor below.

The roof arches are covered, true and smooth, with a coating of cement about one inch thick, and on top of this is laid regular five-ply tar and gravel roofing. The corners between the walls and roof are filled to a height of six inches with cement, beveled at an angle of about 45 degrees, and covered with a copper flashing, this in turn running up under the cap flashing on the vertical face of the walls. The face of the walls above the flashing is then covered with a coat of asphaltum and pitch, to prevent the possibility of any moisture accumulating.

The ground floor (see section Fig. 3) rests upon a bed of cement concrete 12 inches thick. The concrete was mechanically mixed, and consists of one part Portland cement, four to four and one-half part sharp sand, and eight parts crushed

stone. This was put down as dry and stiff as possible, forming a continuous foundation which is sufficient for any of our machines, and very advantageous, as it will enable the location of any machine to be changed without requiring the building of new foundations, nor the sacrifice of old ones. Over this cement concrete is a coating of pitch, applied hot, and above this there is a half-inch coat of tar concrete, so that the possibility of any moisture striking up into the floor planks is prevented. In this foundation are bedded chestnut sleepers, to which are spiked the floor planks. The floor proper consists of 2¼-inch spruce planking, tongued and grooved, over this a diagonal course of matched

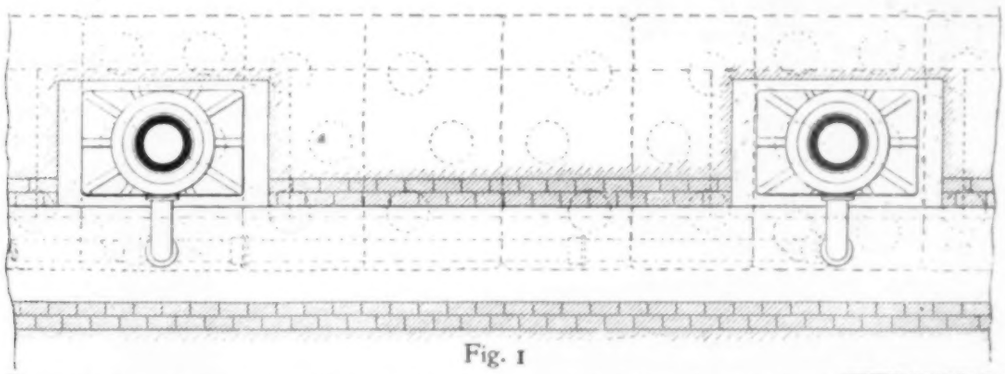
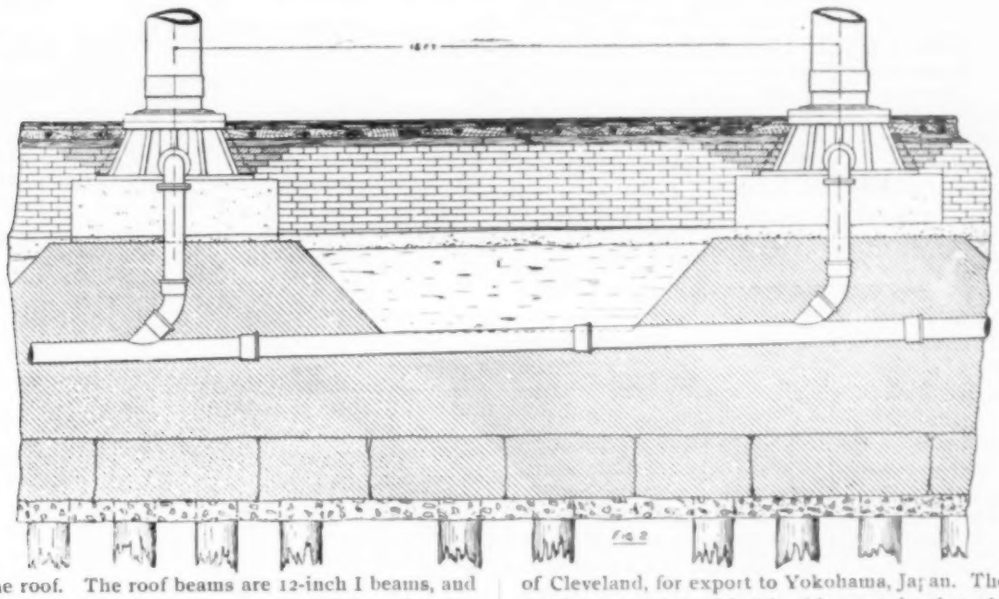


Fig. 1

spruce 1⅝ inches thick, and over all is laid 1⅛-inch hard pine; this is jointed square for convenience in making repairs.

The roof and other beams are supported at the outer ends upon steel Z bar columns enclosed within the pilasters (Fig. 5), to which they are framed in a manner to support the framework entirely independent of the brick wall. At the center of the building, these beams are framed to a double line of 20-inch I beams, which rest upon a single row of cast iron columns placed 16 feet between centers. These columns are 16 inches diameter at the bottom, tapered to 14 inches at the top, for the first floor, and of correspondingly suitable proportions for the other floors. The double row of beams are 20 inch I beams for the second, third and fourth floors, and 15-inch I



beams for the roof. The roof beams are 12-inch I beams, and the other beams 15-inch steel I beams, placed four feet between centers, with four-inch brick arches resting upon the lower flanges (Fig. 4).

The second floor beams are 60 pounds per foot; those of the third and fourth floors are 41 pounds per foot, and the floors are thus capable of safely carrying, in addition to their own weight, a uniformly distributed load of 375 pounds per square foot for the second floor, and 225 pounds per square foot for the third and fourth floors. Over these beams and brick arches is laid the heavy five-inch spruce and hard pine flooring, as described for the ground floor.

The hollow square plan of the building, and the proportion of width to height of stories, together with the windows, which are four feet two inches wide, eight feet between centers, and extend practically the entire height on each floor, from the work-benches to the ceiling, insure all that can be desired in the way of light.

The ventilation is accomplished by means of the ventilating flues, before described in connection with the walls.

The water is conducted from the roof through the iron columns before referred to as supporting the floor and roof beams at the center of the building, the roof beams grading towards these about ⅛ inch per foot. The columns are coated inside with tar to prevent rusting, and after passing down through these the water is carried off through the cast iron column supporting bases, by special outlets connected with the drains as shown in Figures 2 and 3.

A convenient arrangement for running pipes, wires, etc., is obtained by having a drain conduit, or pipe trench near the center of the building. It runs parallel with the main column foundations (see Fig. 3), these forming a part of one side, and varies from two to three feet in depth. The covering consists of removable sections of flooring of the same thickness as the other flooring.

All-Water Shipment of Nails to Japan.

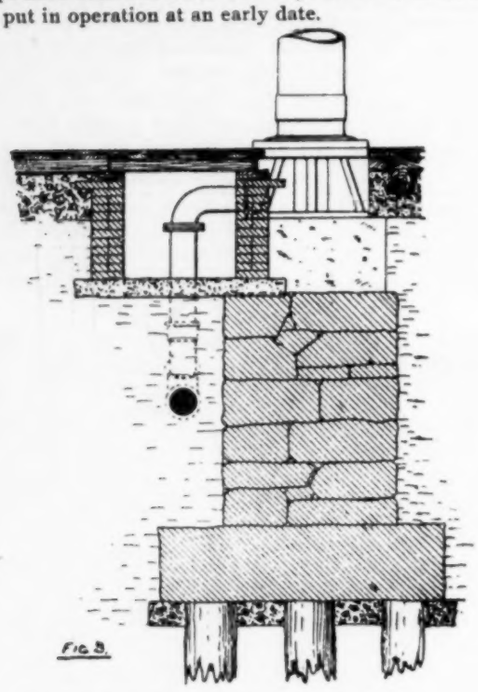
The Cleveland Steel Canalboat Co.'s fleet is on its way to New York, having for a considerable portion of its cargo a shipment of 650,000 pounds of nails, made by the HP Nail Co., of Cleveland, for export to Yokohama, Japan. The significant fact in connection with this shipment is that the canalboats made a rate considerably below that by rail. This was due to the fact that the Canalboat Co. avoided the Buffalo transfer and the switching charges at Cleveland. These, together with the charge for unloading from the cars, amounted to about 45 cents a ton.

The nails will be placed on board a steamer at New York for Yokohama, by way of the Suez Canal. Once before a shipment of wire nails was made by the same company to Japan, but it was made from the Pacific Coast. This is the first shipment of the kind ever made from an interior city, and is only made possible by the use of the steel canal boats on the Erie Canal.

LAKE SUPERIOR IRON MINES.

The report that 70 men were laid off at the Palms mine is in error. There has been an increase in force at that property recently.

Pumps have been started at the Crystal Falls mine and it will be put in operation at an early date.



MODERN SHOP BUILDING.—Pages 8 and 9.

The magnetic ore mine at Quinnesec, Mich., recently discovered by John R. Wood has been acquired by the Illinois Steel Co.

The Aragon mine will put in operation the eight-hour system for underground men. At Ironwood, Mich., the matter is being agitated by the men.

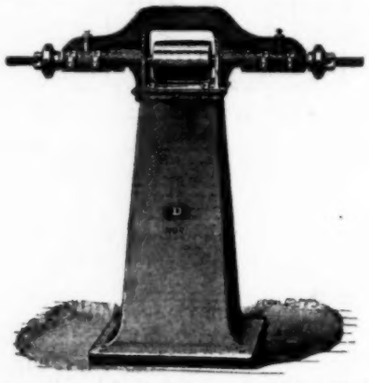
The Duluth, Missabe & Northern is laying out a spur from McKinley to the Pettit property adjoining the old McKinley mine. This is the property upon which an option was given to Eastern furnacemen last winter, but the option has expired. Capt. Roberts will work it himself.

Shipments have begun from No. 1 shaft of the Commodore mine. A large body of high grade ore has been proved up on this property and a new shaft is to be sunk.

At the Franklin group, Mesabi range, 500 men are employed and 1,500 tons of ore is mined daily. The Franklin and Bessemer are shipping from shaft and stockpile; ore is also going forward from the Franklin. A spur track is being put in to the Victoria.

NEW POLISHING LATHE.

The cut shows a new polishing lathe recently put on the market. It is designed to carry either solid leather wheels, wood wheels covered with leather, or buff wheels. As will be seen, the lathe has a heavy, substantial head, with extra long bearings and an overhanging arm, which gives great strength and stiffness. The boxes are protected from the entrance of emery or other dust. The column is hollow, and of sufficient size to permit the machine to be belted from a counter-shaft running below the floor. The head is mounted on a short column for bench use, if desired, but the cut shows the machine as a floor lathe. The boxes are babbitted with the best metal. The spindle may be provided with either a single, tight and loose or a cone pulley. The machine is designed to meet the requirements of manufacturers who desire a first-class lathe, but do not feel like purchasing one of the higher priced machines made by the same company. The spindle is 48″ long, 1½″ diameter in the boxes and 1¼″ between flanges. The



entire weight as shown is about 400 pounds. The machine is made by the Diamond Machine Co, of Providence, R. I., who manufacture a large line of grinding and polishing machinery.

Impending Wage Questions.

The wage committee of the Amalgamated Association of Iron and Steel Workers is called to meet in Pittsburg on Friday of this week. The meeting is preliminary to the annual convention of the association which opens in Detroit next week. Several matters will be considered by the committee, among which it is understood will be the attitude of the tin plate manufacturers, in view of the higher price fixed for steel billets and the sharper competition that will be possible to Welsh tin plate manufacturers under reductions in wages on the other side. The Youngstown lodges, it is understood, will advocate at the Detroit convention a $4.50 puddling rate, a 1.5c. base and an annual settlement, with the abolition of the sliding scale and 60-day adjustments that have ruled in the past year.

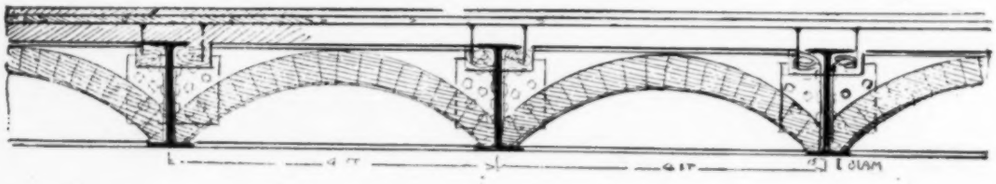


Fig. 4

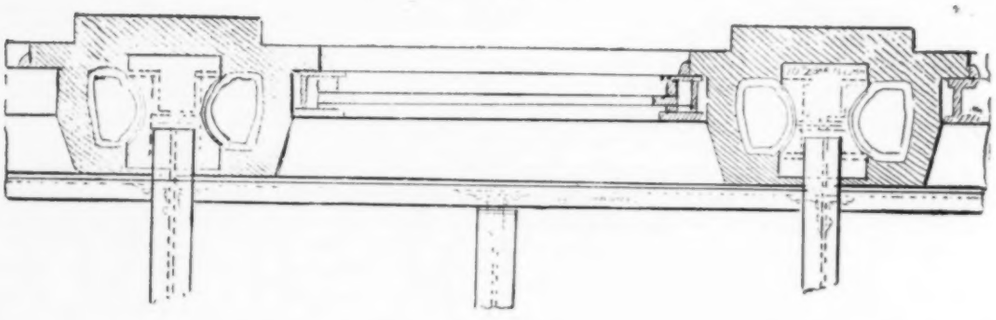


Fig. 5

MODERN SHOP BUILDING.—Pages 8 and 9.

UTILITY AND ADVANCEMENT OF GREEN, DRY SAND, AND LOAM MOLDING.*

BY THOMAS D. WEST.

It is safe to say that 75 per cent of all molders at the present day know little or nothing from experience of "dry sand" or "loam" work. For this reason there are comparatively few in the foundry business that know what elements decide whether certain castings are best or must be made in "dry sand" or "loam," in preference to "green sand." Our old school of apprenticeship largely taught the art of working in all three branches, and the "graduate of the sand heap" was not considered of much account as a molder, unless he could work in any one of the three branches. Molders made after this plan could generally tell at a glance what method was the best for any piece of machinery work.

As a rule, the method that offered the greatest security for obtaining a good casting at the first trial, was invariably the plan adopted. As a "dry sand" or "loam" mold generally far exceeds a "green sand" mold as a sure means of obtaining a good casting, most all massive work was made by these methods; and before the advent of practical foundry literature, rarely were any very massive castings attempted in green sand, a fact which is to be largely charged to the general lack, among molders, of an understanding of the principles involved in the different manipulations necessary to make a good casting. This may seem a strange statement to many at the present day.

While the old school of molders far exceeded those of the present time in being all-round skilled men, able to work in any branch of founding, it is to be said that their knowledge was gained by sad experience, and practice was largely imitative. It was very rare to find a molder who could define the principles involved in any work he might be doing. If he "weighted a cope," he did so by guess work, and if it "ran out" the first time, he simply put on more weight at the second casting, and if this met the same fate, the conclusion was often drawn that it was best to make a "bolting-down floor," which he felt Satan himself with all his eruptions could not raise. It rarely occurred to the molder of fifteen to twenty years ago, that "weighting a cope" involved the question of static head pressure and was simply a problem of physics and figures. This, it may be said, is one of the advances due to practical literature.

As imitative skill has given way to scientific knowledge, or a true understanding of the principles involved in the art of founding, just so fast have improvements been made in methods of molding. As illustrating the changes brought about by this agency, some shops are now making massive castings in green sand that a few years back would not have been thought possible of achievement, except by loam or dry sand methods of molding. It was generally supposed that the more massive the casting, the harder was it necessary to make the "bed" or face of the mold composing its lower body; and on account of this belief, whenever anything very massive was attempted in green sand, the metal often went to the roof of the shop before the mold was half filled.

Briefly stated, success in making massive castings in green sand is due to recognizing the necessity of having the face of a mold no harder for the casting of a massive body than for one of small weight, head pressure being considered equal in each case; and for strength to resist the extra strain that might be due to head pressure of liquid metal, looking to the "backing" or foundation under and around the sides of the mold. To insure a solid "backing," it is best, as a general thing, that all massive castings be "bedded" in the floor, for then if the floor is a dry one, as it should be, and the outer body of the mold is well rammed and protected to resist the strains of head pressure, the danger of "burst-outs" and "blow-ups," as compared with cases in which the bottom portion of heavy castings are "rolled over" or molded in a "nowel," is very materially lessened. It is true many large castings in being molded are "rolled over" and successfully made by such plans; but these are not to be classed as massive work, more often coming under the head of big nothings, when floor or shop room occupied is compared to the weight obtained.

*Read at the first National Convention of Foundrymen at Philadelphia, May 12-14, 1896.

A good plan which the writer has adopted with massive castings made in green sand, is to form all pouring gates with dry sand cores. As it is through the "gates" that the wash and rush of the hot, seething metal can work the greatest injury and start a mold blowing, the wisdom of using cores for forming pouring gates, instead of all green sand, will be very evident. Cores have also been placed at any dangerous corners or flanges that might exist near the gates or in any other portion where it was feared "blowing" might be started from the "vent" not being freely liberated, if such portions were formed of all green sand. Then, again, there are massive castings having projections or portions which may extend deeply from the main body of the casting, that it is often well to form by cores, dry sand or loam sections to lessen the risk of bad work in a casting whose main body might be safely made in all green sand.

Another method now employed by many is to "skin-dry" a green sand mold. This method calls for a grade of "facing sand" possessing a loamy nature, that when coated by wet blacking, the same as generally used to "black" a dry sand mold, and dried by heat, will bake to a firm crust and not go to a dust if the skin of the mold is in the least broken. It requires some experience to attempt "skin-drying," and even good molders, having never done such work, should start with castings on which the loss could not be a heavy one.

Another factor in connection with the making of massive castings in green sand by means of "bedding-in," and often employed for "skin-drying" as well as with raw green sand work, is the preparation of floors. Some shops have a practice of simply throwing in a few pails of water in the hole left by the hot casting and then filling it up with ill-mixed sand, loosely tramped. I have often seen very heavy losses, with danger to life, by such a practice. Castings molded near such holes, on pouring have burst out into the ill-filled hole, the resistance being insufficient to withstand the head pressure exerted against the lower body of the sides comprising the mold which was being cast. Whenever a casting is being taken out of the floor and is not to be made at once in the same hole, all dry and loose sand should be shoveled out. After it has been fairly mixed on the floor, it should be shoveled back in layers about six inches deep and rammed down solid with butt-rammers until the hole is thus well rammed up to the level of the general floor. Such a practice is sure to pay in the end and make it possible to cast daily, massive work in green sand that could not be otherwise attempted in many shops of to-day.

It is the general opinion that the green sand method of molding is in all cases, wherever it can be employed, the most economical. Many err in this conception of founding. As a rule, it requires greater skill and care to produce a large perfect casting in green sand than by dry sand or loam work. By reason of the less risk attached to "dry sand," some shops making duplicate work, have, on account of the difficulty in obtaining skilled green-sand molders, devised riggings to make certain jobs in dry sand. By this means poor tools of molders, or the more intelligent laborers, could be used to turn out good castings; and often such methods materially lessen the cost of production. Many changes have of late years been brought about in shop methods by utilizing "dry sand" to make duplicate castings, where shops have specialties, or very much of a certain line of work to do.

While loam molding has not advanced to any noticeable degree, still, through a better understanding of the principles involved in molding, and specialty shops making their own loam molders, less difficulty is experienced to-day with loam work than existed 10 to 15 years ago. But in a jobbing way, the general heavy-work founder is worse off to-day than ever, in ability to secure good all-around loam molders to turn out creditable work at the first casting.

On general principles, loam molding is the most expensive method that can be adopted, and the less a founder has to do with such work at prevailing prices the less money will he lose. As a rule, loam work is only employed to make large or massive castings that, owing to their great vertical extent or intricate form, could not be made in green sand; and again, the fact that loam molding does not demand complete patterns, often causes whole castings or parts of castings to be made by this method.

In closing this paper, a word should be said as to light work

founding. The advance made in this line is worthy of comment. That methods of light founding now far excel those of a few years back, is to be credited largely to the able management of bright minds laboring to rival competitors. To whatever degree methods in casting may have advanced, no greater achievement has been made than the "casting" of ballots to further the unity of founders as exemplified by this National assembly. May organization among foundrymen reach far and wide until all feel its influence, and this great industry makes the advance which general discussion and the diffusion of the best methods are calculated to secure.

THE CHICAGO BUFFING LATHE.

This improved buffing lathe has been put upon the market to meet the demand from bicycle manufacturers and others, for a simple machine for driving, polishing, grinding and buffing wheels. The design and proportion are such as to allow of a great range of work. The spindle is 48 inches long and 1½ inches in diameter through the bearings and the ends of the spindle are made either 1¼ or one inch. The weight is 340 pounds and the metal is distributed with a view to solidity and an absence of vibration. The machine is made either with tight and loose pully on spindle and intended to be run direct from the line shaft, or with tight pulley only, and furnished with counter shaft. The practice of running polishing lathes direct from line shaft, is thought by the makers of this lathe to be a good one since the first cost is considerably less, it does not require so much belting, takes less power and avoids the trouble experienced with short belts overhead and the almost impossibility of keeping the loose pulleys from grinding up on account of the dust always present in crowded polishing-rooms. The loose pulley on this lathe has a special lubricating feature, which also renders the bearing dust proof. The pulley is made with a false shell, and between the inner bearing of the pulley and the rim is a piece of heavy felt which completely encircles the bearing. Two long wicks, nearly the length of the bearing, are sewed on the felt, and these press against the shaft through two narrow slots, one at either side. This form of pulley has been put to severe tests, and it is claimed, has proved itself capable of meeting the most exacting requirements. The lathes are made by the Chicago Flexible Shaft Co., 142 and 144 Ontario st., Chicago, and further information may be had of the company.

Runyon, Stubbs & Co., Cleveland, will take possession of Anna Furnace at Struthers, O., as soon as certain repairs are made, as called for in the contract. These will be completed sometime in the present month. The purchase of the furnace from the Brown-Bonnell Co., Youngstown, was made some months ago but it was arranged that the latter company should operate it until May 1.

THE Union Trust Co., receivers of the Pittsburg Steel & Iron Mfg. Co., having secured consent of the creditors, will shortly start up Soho furnace. The furnace is now being relined.

THE Ohio Steel Co.'s plant at Youngstown, is temporarily hut down owing to a disabled boiler.

FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, on the evening of Wednesday, May 6. The session was principally devoted to the perfection of the programme for the National Convention. A paper was read by E. C. Will, on the "Storing and Assembling of Patterns." The following were elected to membership: Henry R. Worthington, Brooklyn, N. Y.; Wilbraham Baker Blower Co., Philadelphia; Holyoke Machine Co, Holyoke, Mass.; Joseph Dixon Crucible Co., Jersey City, N. J.; George R. Allen, Philadelphia; American Steel Casting Co., Thurlow, Pa.; Diamond Drill Co., Birdsboro, Pa. Mr. Will's paper is as follows:

"Storing and Assembling of Patterns."

First, I will describe the building of the shelves, their height, breadth and length of space; second, the symbolizing and numbering of patterns and placing them on said shelves; third, the foundry routine, with the different forms and time cards, from the time the orders for castings are received until the castings are delivered.

The shelves to receive patterns are built in tiers of three or more shelves high, and beginning with the floor are lettered —the floor A, the first shelf B, the second shelf C, the third shelf D. The object in beginning with the floor and running the letters up instead of down, is that if occasion require we can add a shelf to the top, but cannot put one underneath the floor to any advantage.

The shelves are an average of five feet wide, to enable the man in charge of patterns to reach a pattern from either side of the tier, and the spaces an average of eight feet in length between supports; the object in having the spaces 5 by 8 feet is that a man can see at a glance if the pattern that he is looking for is in its place. The spaces we number lengthwise—1, 2, 3, 4, 5—as the length of shelves call for. The numbers are tacked on each side of the top shelf and answer for all the shelves underneath them. We keep from 30 to 36 inches aisle room between the tiers of shelves; this depends upon the kind of patterns to be taken in and out; also four to six feet gangway at end of tiers to get to the different aisles. We next number the tiers of shelves 1, 2, 3, 4 and upward.

Having the shelves in order, we now symbolize and number our patterns and place them on the shelves in the following manner: We begin with the patterns of the smallest machine of any particular kind, first, from the fact that all sizes of different kinds of machines generally grow larger instead of smaller, and we go forward in letters and numbers, not backward. For instance, the first lot of patterns we take up are those of an engine; beginning with the letter A and the figure 1, we mark the cylinder A 1, the front cylinder-head A 2, the back cylinder-head A 3, the piston A 4, the gland A 5, the girder or bed A 6, etc.

We next place this lot of patterns on the No. 1 tier of shelves, on A 1, B 1, C 1 and D 1. The next lot on A 2, B 2, C 2 and D 2, and shelve the balance of patterns in the same manner.

Patterns that are too large to shelve we set apart a particular floor space for, and put all patterns of a kind in line, such as cylinders, girders and wheels, and when a pattern is taken away that space is left vacant until the pattern is returned; this makes a place for every pattern.

We now catalogue all our patterns, and give a general catalogue to all departments; we next make a small catalogue for each tier of shelves, containing the symbol and number and name of patterns thereon, and leave this small catalogue on its particular tier of shelves. We also put a small tablet of 2½ by 2½ inch blanks, printed "Patterns delivered to," and a small hook or file on each tier of shelves or particular floor space, so that when a pattern is moved the date, the symbol and number of pattern and the party's name or department that received it is put down on blank and put on file. In this way we have a correct record of all patterns at all times, and when the pattern is returned to its place the small slip on file is destroyed.

We will now suppose that the firm has received an order for a 32x60 inch Corliss engine. The superintendent instructs his clerk, or office help, to make out specifications to all departments having any work to do on this engine.

The specification blank or form is made up as follows: The

sheet is 10½ inches wide and 15 inches long, divided into nine spaces lengthwise. Two inches from top of sheet, there is a head line, in which the first space, one inch wide, is marked "check." The next two spaces make one inch. These are marked "date;" the following space, ⅝ of an inch wide, is marked "No. of pieces;" the space after this one is also ⅝ of an inch wide, and is marked "symbol and number." Then we have a 4½ inch space marked "name of piece," followed by a space 2¼ inches wide, marked "assigned to," and another space ¾ of an inch wide marked "number made." When this specification is filled out it will read in this manner:

S. O. No. 1. Jan. 23, '96.

Dept. C deliver to Dept. D the following castings for 1 32"x60" Corliss engine:

THOMPSON & Co., R. Smith, Supt.

CHECK.	DATE.	PIECES.	SYM. AND NO.	NAME OF PIECE.	ASSIGNED TO	NO. MADE.
.....	Jan. 23	1	A 1	32x60-in. cyl.	John Jones.	.....
.....	.....	1	A 2	Front cyl. head.	.....	.....
.....	.....	1	A 3	Back cyl. head.	.....	.....
.....	.....	1	A 4	Piston.	.....	.....
.....	.....	1	A 5	Gland.	.....	.....
.....	.....	1	A 6	Girder.	.....	.....
.....	.....	.....	.....	Etc.	.....	.....

When this specification is received at the foundry the foreman assigns the work to the different molders and makes out the form described below [and exhibited by the speaker]:

These sheets are put up 50 in a tablet, and are 7 by 4 inches. In the upper left-hand corner is printed, "Mark up your orders every day you work;" also at the top of sheet is printed, "Make up all scrap castings without further orders." Then we have a space for the molder's name and date. Underneath this we have a double head line, divided into spaces, first space ½ inch wide, marked "check." This is full depth of sheet for any remarks, and is followed by spaces marked "number of pieces" and "size and No." ½ inch wide by ¼ inch deep. To the right of this we have a space ¼ inch deep by 5¼ inches long, marked "transferred to," with space for name and date. Seven-sixteenths of an inch below this we have a line the full length of sheet, divided into three spaces, for "No. of pieces," "Size and No." and "name of piece."

Underneath this line we have a space 2 by 6 inches, divided in squares ¼ by ¼ in which the molder keeps count of the castings he makes. On the bottom of this order we have printed, "Tally castings scrap in spaces below," and have a row of ¼-inch spaces for that purpose. If the molder's order calls for 20 castings and he has lost one his order will show 21 castings made in all.

This order made out will read:

"Jno. Jones, Jan. 25, '96. 1—A 1 32 inches by 60 inches cyl."

When this form is made out to this particular molder his name is written in the space marked "Assigned to" on the specification and the date placed on same line in date column. This specification is copied in a daybook of like form, except the daybook contains one more column for the number of the order.

When these molders' orders are written out and copied in the daybook they are given to the pattern carrier, who takes them to the pattern storeroom or building, takes down the different patterns called for, fills a blank with the date, symbol and number, and the party's names they go to, puts all patterns together or assembles them for this particular job. He then notifies the flask carrier to take flasks to suit the different patterns to molders for their particular pieces. In this way there is no delay in the foundry, with a molder waiting for something to do. His pattern and flask are ready for him the day before. This gives him an opportunity to get his sand and fixtures ready for his next day's work.

We will say the regular pattern carrier is off when this order comes in. We give the molder's order to another man or boy of ordinary intelligence and tell him to get the patterns. He takes the orders, goes to the pattern storeroom, picks up the general catalogue, finds the 32x60 Corliss engine on tier 1. He will next take the catalogue of tier 1 and find his first order, "A 1—32x60 cylinder" on space "A 1;" his second order, "A 2 front cylinder head" on "space B 1;" and a continuation of the same routine with all the patterns.

About two o'clock we begin to take up the heat or day's work and make a record in a book for this purpose of each piece each molder has made and will make that day. If the shop is on piece work each molder's, coremaker's and helper's time is counted up and put on his card, which is handed to him at quitting time. If there is any mistake that is the time to rectify it, when everything is on the floor.

When an order is finished the molder turns it in when we are taking up the heat. It then has the date stamped on it, and at the same time we stamp the date in the specification and daybook column marked "check." In this way in a few moments we can turn back to any date within a year or more and tell when a casting was ordered, who made it and when it was delivered.

The time cards are 7x3¼ inches, have a head line for date, name and department and spaced off for three days on each side. Each day's work is put down in one of these spaces. With this card each man practically "O. K's" his own time every evening; it also acts as a check, from the fact that each man puts his card in a box made to receive the cards of his department when he begins work in the morning.

These cards are taken by the timekeeper, who makes a record of the time and returns the cards to the different departments during the day. After the castings have been chipped all scrap castings are laid to one side to be seen by the men that made them. These castings are deducted on the card the next day, or a separate list kept of them and taken off the week's work. All castings and gates are weighed, and these together with the loss in melting must balance the iron charged.

Received From the Trade.

The Morton Tin Plate Co., Cambridge, O., has recently issued a linen-backed hanger, giving sizes and weights of tin plates. It will be sent on application to dealers, manufacturers, tinners, or others interested.

The Kempsmith Machine Tool Co.'s latest leaflet calls attention in a unique way, by copious reproductions of a well known nut, to additions recently made to its lines of milling machines, screw machines and turret lathes.

The third annual edition of "Coal Statistics" has been issued as a neat, blue-covered 16mo. by Alder & Ruley, of Philadelphia. It gives a directory of the coal mines in the United States, together with statistics of production, distribution and other matter relating to the coal trade.

The Marsh Steam pump is illustrated in detail in the 1896 catalogue of the Battle Creek Steam Pump Co., of Battle Creek, Mich. Boiler feed pumps of various types are shown. A feature, to which attention is directed, is the live-steam actuating and governing valve. A large measure of self-government, and at the same time a high degree of efficiency are attained. The catalogue is well arranged and appropriate information is given under the various headings of marine pumps, automatic pumping outfits, vacuum pumps, pressure engines, pumps for heavy liquids, air compressors, naphtha pumps, etc.

The transfer of the property of the Pennsylvania Steel Co., which went into the hands of receivers April 21, 1893, was made by the reorganization committee to the security holders at the annual meeting of the stockholders May 4, but it is not likely that formal possession will be taken for some weeks. Effingham B. Morris, chairman of the reorganization committee, reported sales and deliveries in 1895 of $6,679,956, with net profits of $121,657. The following directors were elected: E. C. Felton, Harrisburg; L. S. Bent, Philadelphia; E. B. Morris, Philadelphia; F. W. Hunnewell, Boston; John Cassels, Washington; Alfred Earnshaw, George Wood, C. Stewart Patterson and E. R. Dick, Philadelphia. E. C. Felton will be elected president-general manager.

George P. Harris & Bro., of Chicago, who have been making distilling apparatus in that city for upwards of 40 years, have just completed and shipped a still for making wood alcohol which promises to have a bearing upon the future market value of that article. Wood alcohol is a by-product of charcoal, and its production is likely to accompany charcoal pig iron making to an increasing extent. With the apparatus in question alcohol can be raised from 40 degrees to 98 degrees proof in one operation. Under the process now in use this requires several operations.

PHYSICAL TESTS & CHEMISTRY OF CAST IRON*

W. J. KEEP, DETROIT, MICH.

The physical properties of cast iron are shrinkage, strength, deflection, set, chill, grain and hardness. *Physical tests* determine to what extent castings possess these properties. *Tensile tests* should not be used for cast iron, but should be confined to steel and other ductile materials.

TABLE I.—TENSILE STRENGTH PER SQUARE INCH.

Iron.	Size of Test Bar .375 Sq. In.	Size of Test Bar 1.128 Sq. In.	Average Per Cent. Silicon.
Iroquois Series, 1.....	20,000	15,700	.80
" " 2.....	20,580	22,500	1.21
" " 3.....	25,050	20,450	1.88
" " 4.....	21,850	19,350	2.01
" " 5.....	22,425	19,750	3.19
" " 6.....	25,550	17,200	3.04
Southern Series, 14.....	14,000	21,300	2.81
" " 13.....	23,525	20,500	3.18
" " 15.....	24,400	20,300	3.50

Compression Test.—Cast iron is employed to resist crushing loads when used in the shape of columns, pedestals and the like, and for this reason this test, using long pieces, should be made, but is generally neglected, from the common erroneous impression that the resistance of a small cube or cylinder, which is enormous, is always in excess of loads which can be applied.

Transverse Test.—As cast iron is commonly used to resist cross breaking, this is the most frequent test to which it is subjected. The ease with which a transverse test can be made is one reason for its general use. Table II. gives the transverse strength of different sizes of test bars, from several different mixtures of iron.

Strength of Cast Iron.—Specifications for castings state the strength required of a test bar which shall be cast from the same iron that is poured into the casting. The strength of the casting is then calculated by the formula $W_1 = \frac{W b_1 h_1^2 l}{b h^2 l_1}$

To ascertain whether this formula gives the correct strength of the casting, I have introduced the following tables.

CHART I.

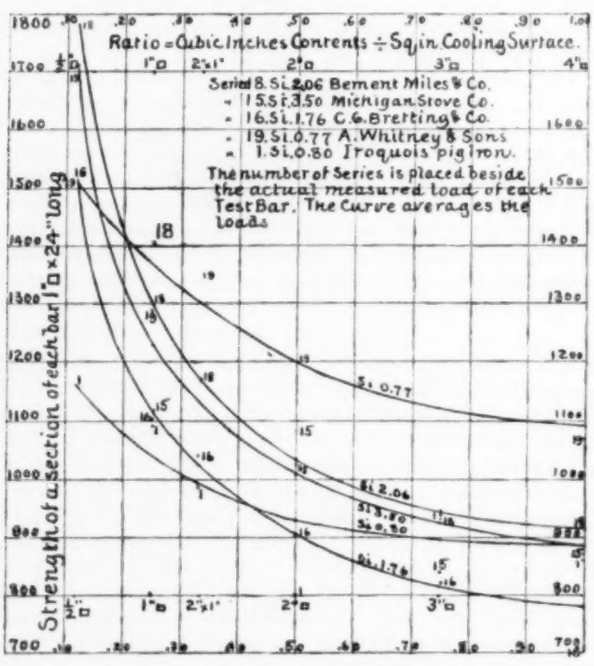

Ratio = Cubic Inches Contents ÷ Sq. in Cooling Surface.
Series 8. Si. 2.06 Bement Miles & Co.
" 15. Si. 3.50 Michigan Stove Co.
" 16. Si. 1.76 C. G. Bretting & Co.
" 19. Si. 0.77 A. Whitney & Sons
" 1. Si. 0.80 Iroquois pig iron.
The number of Series is placed beside the actual measured load of each Test Bar. The Curve averages the loads
Strength of a section of each bar 1" x 24" long.

Table V. gives the strength of full-sized bars. The upper rows of figures are found by applying the formula to the strengths in the column headed 1" sq. x 24" of Table IV., and the lower figures are found by applying the formula to each corresponding strength in Table IV. (The 1" and 2" x 1" strengths of series 1 are averages of all bars of those sizes in Table II.) The irregularities of strengths in Tables II. and III are caused by conditions attending cooling.

Chart I. and Table IV. show the strengths of the same bars unaffected by such conditions.

* Read at the first National Convention of Foundrymen at Philadelphia, May 13, 1896.

TABLE II.—TRANSVERSE STRENGTH OF CAST IRON.

No. Series.		½" Sq. x 12"	1" Sq. x 12"	1" Sq. x 24"	1" Sq. x 48"	1" Sq. x 54"	1" x 2" x 12"	1" x 2" x 24"	2" Sq. x 24"	3" Sq. x 24"	4" Sq. x 2"	Average Silicon.
Iroquois.	1	289	2,589	1 013	513	468	4,181	1,857	6,400	25,200	54,500	0.80
	2	339	2,140	1,023	550	471	4,050	1,958	7,050	22,800	50,450	1.21
	3	389	2 619	1,248	.....	518	4,300	2,280	7,150	19,250	42,700	1.88
	4	427	2,620	1,107	556	517	4,335	1,832	7,025	19,300	48,750	2.01
	5	430	.....	1,232	585	510	.....	2,077	8,400	23,175	42,600	3.19
	6	471	2,214	.....	557	425	4,180	.....	6,225	17,750	42,150	3.04
Southern.	14	378	2,591	1.200	612	512	4,765	1,962	8,275	25,250	52,450	2.82
	13	394	.....	1,173	.....	.....	.....	2,200	8,450	24,050	55,050	3.18
	15	427	.....	1,117	.....	.....	.....	.....	8,650	22,700	56,350	3.50
Foundries.	16	378	.....	1,104	.....	.....	.....	2,079	7,250	22,150	44,500	1.76
	18	446	.....	1,400	.....	.....	.....	2,352	8,200	25,350	58,700	2.06
	19	377	.....	1,292	.....	.....	.....	2,703	9,600	31,600	68,500	0.77

TABLE III.

Strength of a Section 1" sq. x 24" long, found by formula from Table II.

Original Test Bars.	½" Sq. x 12"	1" Sq. x 24"	2" x 1" x 24"	2" Sq. x 24"	3" Sq. x 24"	4" Sq. x 24"
Series 19.....	1,508	1,292	1.351	1,200	1,170	1,070
" 18.....	1,785	1,400	1 176	1,025	938	917
" 15.....	1,708	1,117	.....	1,081	840	880
" 16.....	1,512	1,104	1,030	906	820	695
" 1.....	1,156	1,096	986	800	933	851

TABLE IV.

Readings from the Curves in Chart I averages of Table III.

Original Test Bars.	½" Sq. x 12"	1" Sq. x 24"	2" x 1" x 24"	2" Sq. x 24"	3" Sq. x 24"	4" Sq. x 24"
Series 19.....	1 508	1,365	1,300	1,200	1,120	1,087
" 18.....	1,784	1 300	1,170	1,030	942	955
" 15.....	1,708	1,230	1,130	1,008	920	885
" 16.....	1,512	1,115	1,022	904	812	780
" 1.....	1,156	1,038	990	928	805	885

TABLE V.

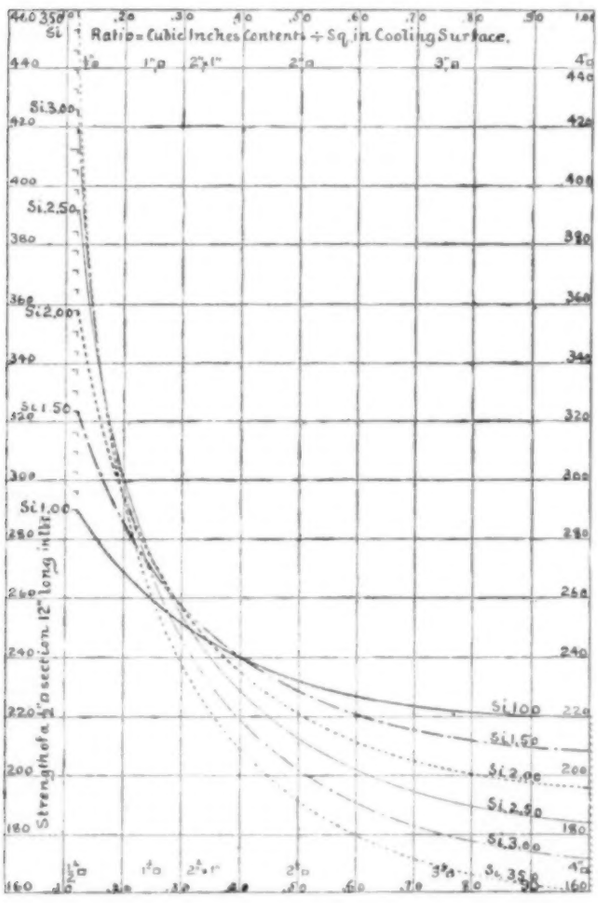
Size of Test Bars.	½" Sq. x 12"	1" Sq. x 24"	2" x 1" x 24"	2" Sq. x 24"	3" Sq. x 24"	4" Sq. x 24"
Series 19, Calculated.....	341	1,365	2,730	10,920	36,855	87,360
" 19, Actual.....	377	1,365	2,600	9,600	30,240	69,568
Series 18, Calculated.....	325	1.300	2,600	10,400	35,100	83,200
" 18, Actual.....	446	1 300	2,340	8,240	25,434	58,560
Series 15, Calculated.	307	1 230	2,460	9,840	33,210	78,720
" 15, Actual.....	427	1,230	2,260	8,064	24,840	56,640
Series 16, Calculated.....	279	1,115	2.230	8,920	30,105	71,360
" 16, Actual.....	378	1,115	2,044	7,232	21,924	49,920
Series 1, Calculated.	259	1,038	2,076	8,304	28,026	66,432
" 1, Actual.....	289	1,038	1,980	7,424	24,165	56,640

In Table II., series 1 to 6 give the strengths of different sizes of test bars made from the same pig iron, with the silicon varying from 1.00 to 3.50 per cent. Chart II. shows the plotted strength of a section of these test bars ½" sq. x 12" long, corrected so as to make regular curves.

Having the measured strength of a test bar ½" sq x 12" long, the formula would make all larger test bars from the same iron of the same proportionate strength; in other words, a ½" sq. section of each size would have the same strength. Chart II., however, shows that in every case a ½" sq. section of a test bar which was cast larger than ½" sq. is weaker, and that the weakest ½" section is that taken from the largest test bar. The strength decreases as the size of the casting increases. The actual strength of a small bar substituted in the formula will indicate too great strength in a large casting, and if the actual strength of a large test bar be substituted the calculated strength of a smaller casting will be too small. The calculated strength must be corrected to correspond with

the strengths shown by Chart II. For example: If the strength of a ½″ sq. test bar 12″ long is 288 lbs. and it is required to find the actual strength of a test bar 2″ sq. and 24″ long, follow the curve which begins at 288 to the perpendicular of the 2″ sq. bar, and we find that the strength of a ½″ sq. section of a 2″ sq. bar is 232. Applying the formula to this last number, we find that the actual strength would be 7,424 lbs., while if applied to 288 it would have been 8,304 lbs., or 880 lbs. stronger than the casting would actually be. Every different size of casting poured from the same iron will have a different proportionate strength, and the largest casting will always be proportionately weakest. The reason for this is that the slower cooling of the larger casting produces a coarser grain. By measuring the strength of a ½″ sq. test bar, and by using Chart II., the approximate strength of any size of casting may be determined. The preceding tables and charts show that a ½″ sq. test bar grows stronger as silicon is increased, because silicon prevents brittleness. They also show that a large casting grows weaker with each addition of

CHART II.


Si. Ratio = Cubic Inches Contents ÷ Sq. in Cooling Surface.
Si 3.00
Si 2.50
Si 2.00
Si 1.50
Si 1.00
Strength of a 1" sq. section 12" long in lbs.

silicon, because slow cooling enlarges the grain more rapidly when there is more silicon. The lower the silicon the weaker the small castings and the stronger the larger castings, and the higher the silicon (up to three per cent) the stronger the small castings and the weaker the larger castings. Strength is simply a question of grain. Chart I. shows that by a careful selection of pig iron and scrap having the closest grain, the greatest strength may be obtained for large castings. The closer the grain without brittleness the greater the strength. The strength of the 4″ sq. test bar in series 1 with 1.00 per cent silicon and in series 15 with 3.50% silicon is the same. By careful selection of pig irons, as in series 18, both small and large castings from the same iron can be made strong, because silicon is high enough to prevent the small castings being brittle, and the grain was so close as to give great strength to the larger castings.

Referring again to Chart II., the variation in the strength from variation of silicon and in the rate of cooling causes each strength curve to cross all other curves, and such crossing is in the region of the test bars 1″ sq. and 2″ x 1″. Test bars of these dimensions do not give as large a variation of strength as test bars either smaller or larger, and they give the same record for more than one percentage of silicon. The ½″ sq. bar shows the largest variation of strength, and in any one mixture its strength generally increases as silicon increases. The 4″ sq. test bar gives a definite record of the variation of strength on account of the variations of silicon, but its record is exactly the reverse of that of the ½″ sq. bar. If the record of these two sizes of test bars are joined by a curve, it will give the approximate strength of all intermediate sizes of test bars, poured from the same iron, or if we know the percentage of silicon, and have the strength of a ½″ sq. test bar, we may draw the curve belonging to that percentage of silicon, beginning at the strength of the ½″ sq. bar, and thus find the approximate strength of a test bar 4″ sq. and of intermediate sizes.

Shrinkage of Cast Iron.—Table VI. contains the measured shrinkages of each of the test bars in the series 1 to 6, with silicon varying from 1.00 to 3.50 per cent, and Chart III. shows these shrinkages plotted and corrected to make regular curves.

CHART III.

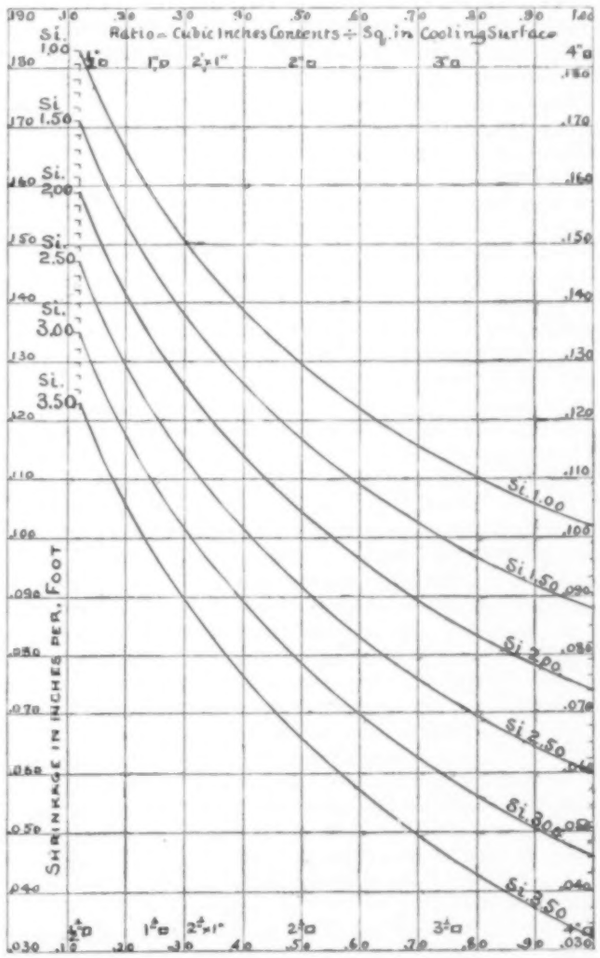


TABLE VI.—SHRINKAGE PER FOOT.

Size of Test Bar.	½″ Sq. x 12″	1″ Sq.	2″ x 1″	2″ Sq.	3″ Sq.	4″ Sq.	Av. Si.
Series 1.....	.183	.160	.148	.131	.116	.102	0.80
" 2.....	.172	.150	.138	.125	.110	.106	1.21
" 3.....	.165	.145	.130	.109	.069	.039	1.88
" 4.....	.162	.143	.123	.099	.066	.128	2.01
" 5.....	.157	.105	.094	.075	.057	.057	3.19
" 6.....	.161	.130	.086	.077	.085	.033	3.04
Series 19.....	.238	.153	.142	.144	.126	.115	0.77
" 18.....	.161	.139	.120	.091	.067	.042	2.06
" 15.....	.123	.098	.083	.072	.063	.035	3.50
" 16.....	.171	.151	.143	.128	.100	.069	1.76

Table VI. and Chart III. show that shrinkage varies in the same proportion that silicon varies. Shrinkage is a measure of the influence of silicon, and is therefore a mechanical analysis. Fortunately, this is a very simple and expeditious way to find the approximate percentage of silicon in a casting. It is the influence of silicon that a founder wishes to measure, and not the actual percentage. In any one mixture

of iron an increase of shrinkage shows a decrease of silicon, and *vice versa*. Having from experience found which shrinkage accompanies the best castings for a given purpose, there is never an exception to the rule, that a greater shrinkage than that which has been found desirable shows that more silicon is needed, and *vice versa*. A shrinkage of .160″ per foot in a ½″ sq. test bar may indicate iron suitable for the best machinery castings, or .125″ for the best stove plate. Shrinkage measures the influence of silicon under all of the conditions existing in the foundry. Silicon can be varied with the greatest facility, and is therefore used to control a foundry mixture and keep its quality uniform. If a new brand of iron is added to the mixture, the shrinkage tells at once whether it contains more or less silicon than the average in the mixture, and whether it is an economical iron to use. Having the shrinkage of a ½″ sq. test bar, refer to the Shrinkage Chart III. to find the approximate percentage of silicon in the iron, and this will tell which curve of Chart II. to use with the strength of the same ½″ sq. bar, to find the strength of any other size of casting poured from this same iron.

Deflection of Cast Iron.—If the same size of test bar is used for all tests, the deflection of the bar indicates approximately the character of grain. Great deflection shows that the iron is soft and that it has an open grain.

Set —After a test bar has been bent by a test load, and the load has been removed, the bar will spring back, but will not fully regain its original form. The amount that it remains bent is the set, and it gives the same information as a measure of deflection.

Chill —The depth of chill that can be given to a test bar is measured by making the mold at the end of the test bar of cast iron. This absorbs the heat so rapidly that the iron sets immediately it touches the chill. The thickness of this instantaneous solidification is the depth of chill. The chilling property of cast iron is imparted in the furnace, and is probably due to some tendency of carbon and silicon to combine under peculiar conditions. Generally the more silicon the less the chill, but the simple presence or absence of silicon will not account for the phenomenon of chilling. To get a good chill, irons must be used which chill naturally.

Spongy Spots or Cavities.—The founder usually calls these spots shrink holes, and it is quite common for him to call the settling of the iron in the gate shrinkage. The loss of heat will probably account for a part of this. In large castings this settling of the fluid iron is supplied by feeding more hot metal. To allow this metal to reach the part which shall become solid last, a communication is kept open by churning with an iron rod. The shape of a casting as well as the size determine these so-called shrink holes. Cast iron expands after it has become solid, not at the time of the solidification of each crystal, but after a rigid shell is formed. This expansion continues for some time. If a casting is so shaped that some portion is partially fluid while this expansion of the shell of the casting is taking place, there will not be enough metal to fill the interior, and a cavity is the result. These spongy holes are not therefore produced by shrinkage, but by the expansion of the shell of a casting. Low silicon iron expands less and sets more quickly than that which contains more silicon. (See Trans. Am. Soc. Mech. Eng., Vol. XIV., p. 1125), and it has been found that for large castings such low silicon iron will need much less feeding, and will contain less spongy spots than iron which contains a large percentage and which remains perfectly fluid at the center until the last crystal has formed. It may be too soon to propose the name of "expansion holes" for these spongy spots, but the time is not far off when the term shrinkage will be restricted to the external contraction produced by loss of heat, and which the pattern maker provides for with his shrink rule.

Chemical Composition and Physical Quality —There have been very few records which would allow a direct comparison between the physical and chemical properties of cast iron. The complete records of the Committee on Tests and Methods of Testing, of the American Society of Mechanical Engineers, will be published during the present month, and the tables given in this paper are taken from those records. The tests are the most complete and extensive that have ever been made. The Committee at the outset associated with themselves the eminent chemists, Messrs. Dickman & Mackenzie, of Cleveland and Chicago, who have made full analyses of all test bars and of all materials used. Professors R. C. Carpenter and C. E. Houghton, of Cornell University; Prof. C. H. Benjamin, of Case School of Applied Science, and Prof. I. H. Woolson, of Columbia College School of Mines, have tested all of the bars, except those ½″ sq., which were tested with Keep's Autographic Testing Machine. We are now able to compare the most accurate chemical determinations with the best physical tests.

Before beginning this work, the Iroquois Furnace Co., and the Ashland Iron & Steel Co., (Wis.) each sent three tons of carefully selected pig iron, and one ton of Ohio iron was procured containing 10 per cent. of silicon. Each of these irons was furnished with a guaranteed analysis, and each pig was broken into small pieces to insure a uniform grain. After the iron was received, drillings from 25 pigs of each of the three irons were analyzed. The proportions of the irons needed to make silicon vary in half per cent. intervals from 1 00 to 3 50 per cent., were calculated, and each iron was carefully weighed and packed in labeled boxes with the coke for melting. This iron was mixed according to the most careful chemical analysis. To make the investigation cover regular foundry practice, four founders made test bars from their regular mixtures. The Michigan Stove Co. made series 15 from all Southern iron. C. G. Bretting & Co., Ashland, Wis., used "Hinkle" charcoal pig iron and scrap for series 16. Messrs. Bement, Miles & Co., of Philadelphia, made series 18 from their best mixture for heavy machine castings, and Messrs. A. Whitney & Son, of Philadelphia, made series 19 from their regular car wheel mixture.

TABLE VII.

	Series.	Nominal Silicon.	Per Cent. of Silicon.						Si. Av.
			½″ Sq.	1″ Sq.	2″ x 1″	2″ Sq.	3″ Sq.	4″ Sq.	
		p. c.							
Iroquois	1	1.00	.83	.79	.78	.82	.72	.88	.81
	2	1.50	1.09	1.14	1.70	1.33	1.10	.88	1.26
	3	2.00	1.73	1.73	1.70	1.50	2.17	2.50	1.88
	4	2.50	2.13	1.69	1.60	1.80	2.17	2.07	2.01
	5	3.00	2.42	2.65	2.40	3.36	3.67	4.67	3.19
	6	3.50	2.74	2.69	2.70	2.62	4.30	3.22	3.04
Southern	15	.....	3.29	3.50	3.52	3.48	3.75	3 42	3.51
C. G. Bretting & Co.	16	.....	1.90	1.86	1.68	1.61	1.83	1.70	1.76
Bement, Miles & Co.	18	.....	2.29	2.09	2.24	1.82	2.06	1.88	2.06
A. Whitney & Sons	19	.....	.87	.72	.78	.81	.68	.73	.77

Silicon and Physical Quality.—A comparison of tables VI and VII shows a very close correspondence between the percentage of silicon and the shrinkage of any one size of test bar, but while the silicon is supposed to be uniform in all the sizes of test bars poured from the same iron, the slower cooling of the larger bars has decreased their shrinkage.

The variation in shrinkage is much more regular than the variation in silicon, which shows that shrinkage measures the whole casting, while a chemical analysis measures a few drillings taken from one spot. If an analysis of silicon in the pig iron would indicate what the silicon would be in the casting, it would allow a guess to be made as to the physical quality of a casting, but the actual quality must be found by a physical test. For example, series 1 and 19 contain the same silicon, and yet the physical quality of the castings are entirely different. The amount of silicon in series 16 and in series 18 does not give the slightest hint that 18 will be strong and that 16 is weak. The difference is wholly physical from beginning to end. Scrap is broken and graded according to fracture into different piles, but each piece of scrap was made in a different foundry, from a different iron mixture, and would show a different chemical analysis. There can therefore be no such thing as grading scrap by chemical analysis. The grading is purely physical, and the grading of pig iron is much the same. A soft, close grained pig iron (or scrap) will generally make a soft and strong casting, irrespective of its chemical analysis. Increase of silicon in any individual mixture (to 3.00 per cent.) increases the strength of small test bars, but decreases the strength of large test bars. Iron deficient in silicon is brittle and weak, but when too much silicon is added, the iron again becomes brittle and weak. The slight variations of silicon

shown in the table, in any one series, do not conform to the variation in strength at all. Strength is entirely a matter of grain, and the reason for the variation of strength with silicon is that silicon influences the size of grain. The only way to determine strength is by a physical test, corrected by Chart II.

TABLE VIII.—SIZE OF TEST-BAR ½″ SQ. X 12″ LONG.

Total Carbon.	Silicon.	Shrinkage.	Strength.	Deflection.	Chill.
3.24	2.87	.131	.485	.20	.09
.....	2 31	.162	.403	.22	.07
.....	2 17	.180	.415	.22	.05
.....	3.37	.126	.478	.21	.07
.....	3.31	.132	.425	.21	.02
.....	3.19	.146	.439	.22	.03
.....	3.13	.141	.436	.21	.03
.....	3.06	.150	.314	.....	.03
.....	2.89	.153	.435	.21	.02
.....	3.04	.166	.402	.22	.04
3.08	2.85	.172	.413	.21	.04

Silicon never behaves the same in different iron mixtures. One pig iron, that is open grained, will make as soft castings with 1.50 per cent of silicon as another pig iron with 2.00 per cent. of silicon, and the strength can be made the same in each case.

The same shrinkage always shows the same influence of silicon, but for the reasons just mentioned the shrinkage of a one-half inch test bar may be .160″ for 1.50 per cent. of silicon in one case and for 2 00 per cent. in another case.

The percentage of silicon, as found from the shrinkage of the casting by Chart III, is only approximate, but the shrinkage shows the exact influence of the silicon, and whether more or less is needed to produce the required qualities in the casting. To illustrate this the following are actual records of three mixtures of southern pig iron. Each mixture shows a close correspondence between shrinkage and the actual silicon. The last two mixtures show that the same percentage of silicon did not exert the same influence as in the first mixture, because there was less carbon for it to act upon.

It is fortunate that a given percentage of silicon does not, in every case, produce the same result in different mixtures of iron, because it enables the founder to vary the irons, without changing shrinkage or silicon, until he has obtained the greatest possible strength.

Diffusion of Silicon in Cast Iron.—Silicon is more unevenly diffused than any other element. It has been supposed that if the product of a blast furnace could be caught in a mixing ladle before it was run into the pig bed, an iron would be produced which would make castings of homogeneous chemical composition If in Table VII we subtract the lowest record in a series from each other record, the remainder will show the excess of silicon in each test bar poured from iron which was supposed to contain the same percentage of silicon

Series 1 was made of low silicon Iroquois pig iron, just as it came from the furnace; the silicon was, therefore, as evenly diffused as it would be in any iron. The average silicon in the test bars was .80 per cent. The variation was .16 or an average of .08 per cent., which represents the diffusion. Series 19 was probably made of pig irons of very nearly uniform composition, and the average silicon in all test bars was 77 per cent. The variation was .19, with an average of .09 Series 16 was made of No. 1 Hinkle pig iron and uniform scrap. The average silicon in test bars was 1 76. The variation was .29, and the average .15.

Series 18 was made from pig irons of nearly uniform composition and good scrap. The average silicon in the test bars was 2.06, with variation .42 and an average of .24.

Series 15 was made from southern pig iron with silicon from 2 00 to 3.50, and a silvery iron with silicon 5.00 per cent. The average silicon in test bars was 3 51, the variation was .46, and the average .22.

The iron of Series 19 and of 18 was caught in a 1,200 pound mixing ladle, and then into a 600 pound ladle, from which it was transferred to small pouring ladles. The pig irons were of nearly uniform composition to begin with, and the mechanical mixing was as perfect as it could be made, and yet there was a variation of .29 and .42, with averages .15 and .24, showing that mechanical mixing will not insure uniform diffusion. The single pig iron of Series 1 was melted in a clean cupola, and yet there was a variation of .16 and an average of .083.

Series 15 is an example of the practice of imparting silicon by a low silicon silvery iron. The iron was melted at the rate of eleven tons per hour, and was caught as fast as it melted, and no effort was made to obtain even diffusion. The variation of .46 and average of .22 shows that as perfect diffusion may be obtained without as with the mixing ladle. Series 2 and 6 are made from the same pig iron as Series 1, with increasing additions of a 10 per cent. ferro-silicon. The diffusion of silicon is very irregular, but the average variations increase as the silicon increases, showing in connection with the other series that the diffusion is less complete as silicon increases in quantity. Comparing Series 2 to 6 with the other series, and especially with 15, it is evident that it is not possible to obtain a uniform diffusion of silicon when very high silicon iron is used.

Loss of Silicon in Remelting.—An analysis of drillings from three pigs of Iroquois pig iron by Mr. C. D. Chamberlain gave .88 per cent., and an analysis of drillings from twenty-five pigs by Messrs. Dickman & Mackenzie gave .98 per cent. silicon. The analysis of each of the six sizes of test bars of Series 1 showed a variation of silicon between .72 and .83, or the same variation as the two analyses of the pig iron. The average silicon in the six castings was .80 per cent., showing a loss during the remelting of .08 to .18 of silicon, and indicates that there is a loss of as much as 10 per cent. of the silicon in the iron during remelting in a cupola

There could not have been a more careful mixture of iron to produce given percentages of silicon than in the Series 1 to 6, and an excess of silicon was added, for it was expected that there would be a loss in remelting. The calculated and average silicons, by analysis, are shown in Table IX.

TABLE IX.—LOSS OF SILICON IN MELTING.

No. Series.	1	2	3	4	5	6
Calculated Silicon	1.00	1.50	2.00	2.50	3.00	3.50
Silicon by Analysis.....	.80	1.21	1.88	2.01	3 19	3.04

To show how impossible it is to produce an exact percentage of silicon in castings, even by an analysis of pig iron, Table X gives the calculated and actual silicons in six crucible heats. The Iroquois pig iron was supposed to contain .88 per cent. of silicon. The additional silicon was added by the 10 per cent. ferro-silicon, and no excess was added to make up for loss. The variation in silicon, as shown by the analysis of Mr. E. E. Mains, indicates that there must have been an unequal diffusion of silicon in the material used.

TABLE X.—LOSS OF SILICON IN MELTING.

Silicon Calculated.....	1.00	1.50	2.00	2.50	3.00	3.50
Silicon by Analysis.....	1.23	1.64	2.04	2.25	3.10	3.49

These examples seem to prove that it is possible to obtain simply an approximation of the silicon in a pile of pig iron, and that it is much less possible to obtain the percentage of silicon in a pile of scrap, and that having obtained an approximation by analysis, the loss of silicon during remelting, and the uneven diffusion of silicon in the casting, make it possible to obtain, by an analysis of the original materials, only an approximation of the percentage of silicon in the casting, and that a prediction of the percentage of silicon to be found in the casting must, from the nature of the case, be somewhat of a guess.

An analysis of the casting itself gives the only reliable information, and this is only approximate from the uneven diffusion of silicon. A measure of the shrinkage of a one half inch test bar, poured from the same iron as the casting, gives an accurate measure of the influence of silicon.

Combined Carbon and Physical Quality.—Comparing Table XI with Table VII, we find that combined carbon decreases as silicon increases. Comparing with Table VI, we find that shrinkage and combined carbon vary together, and comparing each of the size of test bar we find that both silicon and slow cooling generally decrease combined carbon as well as shrinkage. The decrease of combined carbon does not produce the decrease of shrinkage, but both are decreased by slow cooling. Slow cooling does not always decrease com-

bined carbon, but it always decreases shrinkage, as shown by Series 2, 15, 16 and 19. If we compare combined carbon with strength in Charts I and II, we find that the strength of the one-half inch square test bar increases with the decrease of combined carbon. The way silicon prevents brittleness is by diminishing combined carbon. Slow cooling decreases strength by making the grain open, and the same slow cooling decreases combined carbon. This decrease of combined carbon strengthens all sizes of castings by removing brittleness, but the increase in the size of grain is so much more rapid that the final effect of slow cooling is a decrease of strength, but it is not the decrease of combined carbon that decreased strength. To prove this, examine series 2, 15, 16 and 19, in each of which the combined carbon is substantially the same

TABLE XI.

	Series.	PER CENT. OF COMBINED CARBON.					
		½" Sq.	1" Sq.	2" x 1"	2" Sq.	3" Sq.	4" Sq.
Iroquois	1	1.46	1.25	1.05	.80	.76	.70
	2	.70	.54	.59	.56	.54	.60
	3	.48	.45	.42	.37	.34	.13
	4	.45	.48	.43	.36	.11	.10
	5	.35	.16	.20	.11	.10	....
	6	.37	.38	.30	.15	.11	.08
Southern	15	.10	.09	.09	.09	.11	.08
C. G. Bretting & Co.	16	.49	.78	.72	.49	.58	.44
Bement Miles & Co	18	.45	.52	.50	.24	.12	.11
A. Whitney & Sons..	19	2.95	.99	.81	.81	.87	.89

for each size of test bar, and therefore the decrease in strength cannot be ascribed to any decrease in combined carbon, and yet the strength decreases exactly the same as in other cases.

The opinion that combined carbon produced strength originated in the examination of such series as No. 1, where the strongest castings contained a considerable amount of combined carbon, and also because the foundryman has discovered that pig iron, which contains a large percentage of combined carbon, produced the strongest large castings. As a general thing low silicon, high combined carbon, and a close grain go together, but it is the close grain that produces strength. The slow cooling decreases combined carbon in such low silicon iron and thus prevents the brittleness which made the ½" casting weak, and thereby makes the larger casting strong, and in such low silicon iron slow cooling does not increase the size of grain as much as when there is more silicon.

TABLE XII.

	Series.	PER CENT. OF GRAPHITIC CARBON.					
		½" Sq.	1" Sq.	2" x 1"	2" Sq.	3" Sq.	4" Sq.
Iroquois	1	2.36	2.60	2.83	3.08	3.05	3.13
	2	3.20	3.32	3.24	3.33	3.32	3.31
	3	3.21	3.28	3.32	3.40	3.36	3.55
	4	3.10	3.24	3.27	3.41	3.60	3.25
	5	3.19	3.40	3.31	3.47	3.38	3.42
	6	3.01	3.08	3.08	3.24	3. 9	3.23
Southern	15	3.03	3.01	3.07	3.06	3.03	3.11
C. G. Bretting & Co.	16	3.30	3.10	3.08	3.32	3.22	3.31
Bement Miles & Co.	18	2.90	2.83	2.92	3.06	3.11	3.20
A. Whitney & Sons..	19	.79	2.86	2.98	3.00	3.02	2.97

Graphitic Carbon and Strength.—As graphite increases in proportion as combined carbon decreases, it has been inferred that the greater the percentage of graphite the weaker the casting. It has also been supposed that the flakes of graphite separated the grains of iron, and in that way cut up the casting and weakened it. It has also been supposed that the amount of graphite determined the size of the grain and therefore weakened the casting. The reasoning which applied to combined carbon, if reversed, also applies to graphite, but there are other proofs. The size of the grain and the size and location of the spaces between the grains is determined by the slowness of cooling before the graphite is formed. A casting one inch square and two feet long, cooled in its own mold, becomes perfectly solid in one minute, but the graphite is not wholly formed until it has been solid for ten minutes. When the necessary temperature is reached the combined carbon changes to graphite, which drops into the spaces between previously formed crystals of iron. (Trans. Am. Soc. Mech. Eng., Vol. XVI, page 1124.) A comparison of the series presented will fail to discover any relation between graphite and strength.

TABLE XIII.

	Series.	PER CENT. OF TOTAL CARBON.						Average Per Cent.
		½" Sq.	1" Sq	2"x1"	2" Sq.	3" Sq.	4" Sq.	
Iroquois	1	3.82	3.85	3.88	3.88	3.81	3.83	3.845
	2	3.90	3.86	3.83	3.89	3.86	3.91	3.875
	3	3.69	3.73	3.74	3.77	3.70	3.68	3.718
	4	3.55	3.72	3.70	3.77	3.71	3.75	3.700
	5	3.54	3.56	3.54	3.58	3.48	3.52	3.553
	6	3.38	3.46	3.38	3.39	3.30	3.31	3.370
Southern	15	3.13	3.10	3.16	3.15	3.15	3.19	3.146
C. G. Bretting & Co.	16	3.79	3.88	3.81	3.81	3.80	3.75	3 806
Bement Miles & Co.	18	3.35	3.35	3.42	3.30	3.23	3.31	3.326
A. Whitney & Sons	19	3.74	3.85	3.79	3.81	3.89	3.86	3.823

TABLE XIV.

	Series.	PER CENT. OF PHOSPHORUS.					
		½" Sq.	1" sq.	2"x 1"	2" Sq.	3" Sq.	4" Sq.
Iroquois	1	.211	.213	.214	.215	.216	.216
	2	.273	.269	.270	.271	.272	.270
	3	.270	.267	.268	.267	.266	.267
	4	.284	.283	.281	.280	.283	.281
	5	.333	.331	.330	.327	.325	.328
	6	.300	.299	.296	.298	.297	.299
Southern	15	.980	.975	.972	.972	.971	.973
C G. Bretting & Co.	16	.309	.330	.327	.325	.328	.330
B ment, Mil s & Co.	18	Average, .342 per cent.					
A. Whitney & Sons.	19	" .353 " "					

TABLE XV.

	Series.	PER CENT. OF SULPHUR.					
		½" Sq.	1" Sq.	2"x 1"	2" Sq.	3" Sq.	4" Sq.
Iroquois	1	.056	.054	.050	.046	.049	.041
	2	.046	.040	.040	.039	.039	.039
	3	.032	.030	.030	.033	.036	.030
	4	.045	.046	.047	.040	.044	.044
	5	.017	.021	.027	.031	.030	.030
	6	.034	.033	.034	.033	.028	.028
Southern	15	.088	.093	.088	.089	.087	.089
C. G. Bretting & Co.	16	.025	.030	.031	.029	.030	.029
Bement, Miles & Co.	18	Average, .052 per cent.					
A Whitney & Sons	19	" .101 " "					

TABLE XVI.

	Series.	PER CENT. OF MANGANESE.					
		½" Sq.	1" Sq.	2" x 1"	2" Sq.	3" Sq.	4" Sq.
Iroquois	1	.35	.36	.37	.35	.34	.36
	1	.31	.30	.30	.31	.30	.32
	3	.50	.51	.49	.46	.51	.48
	4	.35	.30	.32	.33	.34	.35
	5	.36	.39	.38	.37	.37	.38
	6	.43	.45	.41	.40	.44	.43
Southern	15	.50	.49	.50	.50	.49	.51
C. G. Bretting & Co.	16	.57	.38	.37	.38	.36	.38
Bement, Miles & Co.	18	Average, .354 per cent.					
A. Whitney & Sons.	19	" .350 " "					

Total Carbon and Strength.—There must be a relation between total carbon and strength, but local conditions cause such variations that it is difficult to collect data to prove its influence. In the series reported in this paper there is considerable variation in total carbon, and yet from these records there is no relation apparent. It seems impossible to make

Black Putty in your Boiler?

THAT'S OIL!

WHAT WILL KEEP IT FROM GOING IN—NOT HALF OF IT—BUT ALL OF IT?

A COCHRANE SEPARATOR,

WHICH IS EQUALLY EFFICIENT FOR TAKING WATER OUT OF LIVE STEAM.

COCHRANE HEATERS,
COCHRANE SEPARATORS,
WHARTON-HARRISON SAFETY BOILERS.

HARRISON SAFETY BOILER WORKS,
MANUFACTURERS. PHILADELPHIA, PA.

test bars with carbon the only variable. There is also very little practical interest in the question, because the furnaceman cannot regulate the amount of carbon, and the founder cannot tell what percentage his pig iron contains, and cannot increase it. He can add wrought iron scrap and thus diminish it, but the experiment does not show the influence of carbon, because such addition closes up the grain of the casting and thus increases strength, and renders the experiment useless as a test of carbon.

Diffusion of Carbon in Cast Iron.—The remarks regarding diffusion of silicon apply equally to all elements. Probably a variation of .05 is as near as can be expected, and the extremes of variation will be 0 to .12. Remembering that series 18 and 19 were taken from a mixing ladle, the wide variation in the diffusion of carbon in these series is surprising.

Phosphorus, Sulphur and Manganese in Cast Iron.—The variation of phosphorus and sulphur is sufficient to show their influence in ordinary castings, but they do not seem to decrease strength, or to exert any other injurious influence.

Phosphorus and manganese are very evenly diffused, while sulphur is very unevenly diffused.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

W. E. Dewey, 4950 Washington ave., Chicago, wants to buy a milling machine, with or without a head. State size, make, price and condition.

Near Newark, O., a company, in which ex-Gov. Campbell, of Ohio, is interested, has secured an option on a tract of land, and it is said, intends to erect a plant for the manufacture of weldless tubing.

The Watt & Bros. Steel Co., York, Pa., was recently granted a charter with a capital stock of $30,000. It will shortly commence the erection of a plant and will be open for bids on new machinery, etc.

The George D. Whitcomb Co. has been incorporated at Chicago with a capital stock of $100,000, to manufacture machinery, tools, etc., by George D. Whitcomb, Walter Dalzell, and William C. Whitcomb.

A. Little, A. W. Pollock, W. H. Borland, and others, of Washington, have organized a company for the manufacture of steel tools, and will apply for a charter at once. The capital of the new company is $20,000. A plant will be erected and employment given a large number of men.

Additions, Enlargements, Removals, Etc.:—

The Chattanooga (Tenn.) Steel Roofing Co. will erect an additional building 70x70 feet.

A 61x100 feet addition is to be made to the foundry of the Whitinsville Machine Works, at Whitinsville, Mass.

It is reported that the Westinghouse Electric & Mfg. Co. proposes to add two more shops to its great plant at East Pittsburg. Each will be 500 feet long.

The Girard Stove & Foundry Co., Girard, O., is erecting a 15-ton air furnace to better facilitate the manufacture of rolls. A frame addition will be erected to cover this department.

The Washburn & Moen Mfg. Co. will rebuild its wire factory recently burned at Worcester, Mass., and an addition 248 x234 feet in rear, 119 feet deep and 24 feet high adjoining its present iron works.

The Midvale Foundry Co., Allentown, Pa., is erecting a new brick building 75x100 feet, one story high, for use as a molding shop, the present accommodations being too limited. The company has found business in architectural and machine castings, plumbers' and general castings very satisfactory.

New Construction:—

Augustus Mample, of Bath, Me., has started the work of rebuilding his foundry, which was burned last winter.

The Arnold Metal Wheel Co., New London, O., has commenced the erection of a new brick foundry, 34x64 feet.

J. H. Day & Co., of Cincinnati, will build machine shops covering about 200x250 feet, devoted to the construction of special machinery.

The New York & Cleveland Gas Coal Co. is about to erect car shops at Turtle Creek, Pa., where the company will build and repair its own cars. About 50 men will be employed.

G. L. Anderson & Co. are erecting a brass and bronze foundry at Birmingham, Ala., for the manufacture of car brasses, rolling mill and furnace work. A new 500 h. p. dynamo also has been added.

At Barberton, O., the foundations of the machine shop of the Stroh-McIntosh plant are completed. There will be three buildings, a machine shop 40x100, two stories, a foundry 50x 60, and an engine room 30x40.

The work of erecting the new buildings of the Elliott-Washington Steel Co., at New Castle, Pa., will begin July 15, by which date the buildings of the Fleming Boiler Works will have been removed from the proposed site.

The Norfolk & Western will, during the coming summer, build the shops at Kenova, W. Va., which have been in contemplation since the Ohio River extension of the road was completed, and for which the plans have been made for two years.

It is stated that the Chapin & Harris Galvanized Iron Co. will locate a new plant at Attica, N. Y. The citizens of Attica have subscribed a $10,000 bonus and given the concern a site. It is hoped that the new plant will be running with a force of 50 men by Aug. 1.

The Boston & Montana Consolidated Copper & Silver Mining Co., of Great Falls, Mont., is erecting a new electrical power house in connection with its large mining plant. This building is to be modern in all respects. The Berlin Iron Bridge Co., of East Berlin, Conn., has the contract for furnishing the steel work. The building will be absolutely fire-proof and the covering will be lined with the Berlin company's patent anti-condensation roof lining. This material has proved very efficient for lining on engine and dynamo room roofs,

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick.

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Home Office and Works:—MOUNT SAVAGE, Allegany County, Md.

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TENSILE STRENGTH, 60,000 TO 80,000 LBS.

Homogeneous, Clean and Solid. Suitable for Car Couplers and Knuckles; Crank Shaft and Gearing.

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THE AMERICAN SMOKELESS FURNACE CO.

The "CLEVELAND" is the Best UNDERFEED Furnace.
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Both ARE SMOKELESS.

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THE AMERICAN FIRE BRICK & CLAY CO., Mineral Point, Ohio.

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Our large capacity, 8,000,000 annually, and modern plant, enable us to handle contracts of any size promptly.

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RUST ABSOLUTELY PREVENTED ON MACHINERY, TOOLS AND METALS BY MANNOCITIN

READ OPINIONS OF LEADING AM'MFRS.

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"THE IRON TRADE REVIEW"

is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

and the bridge company is constantly receiving orders for such work from all parts of the country.

Fires and Accidents:—

The Vulcan Iron Works, San Francisco, burned May 10. Loss $200,000.

The foundry of the Keystone Plow Works at New Castle, Pa., was damaged by fire on April 28.

Depree & Ellenbaas's Wagon Works, Zeeland, Mich., were destroyed by fire May 10. Loss $25,000.

Fire on May 7 in Wm. Henderson's foundry, New Brunswick, N. J., destroyed both it and the Empire Machine Works adjoining.

General Industrial Notes:—

The Loeb Foundry Co., Decatur, Ill., has changed its name to the Decatur Malleable Iron Works.

The No. 1 furnace of the Sheridan Iron Co., at Sheridan, Lebanon Co., Pa., has been blown out.

The machinery molders of Cleveland have decided that they will not ask for an increase in wages this year.

The Garvin Machine Co. has leased for a term of years the eight-story building 72x160 feet now nearing completion at Spring and Varick sts., New York. The show room will be on the ground floor, the office will occupy a part of the floor above, while all the rest of the building will be used for manufacturing.

The Diamond Machine Co., of Providence, R. I., is shipping to the Japanese government a large order for grinding machinery received through its London house. The shipment comprises a large number of articles, among others, 10 of the Diamond Machine Co.'s large size water tool grinders.

First-Class Steamboat Service Between Detroit and Cleveland.

D. & C. floating palaces are now running daily between Detroit and Cleveland, and on May 1 commenced to run daily between Cleveland, Put-in-Bay and Toledo. If you are traveling between the above points, take advantage of a water trip and save money. Spend your vacation on the Great Lakes. Send for illustrated pamphlet. Address A. A. Schantz, G. P. A., Detroit, Mich.

THE largest casting ever made in the Cumberland Valley, was that recently completed at the foundry of the Frick Co., at Waynesboro, Pa. The castings were for a 30-ton driving wheel and were made in two pieces, each of 15 tons weight.

U. BAIRD MACHINERY CO.

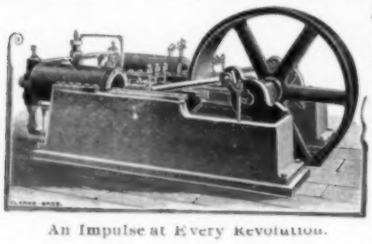
PITTSBURG, PA.

Have a Special Lot of Second-Hand Tools. All in First-Class Condition.

1—55″ Allen Riveter.
1—24x24x7 ft. New Haven Planer.
1—30x30x8 ft. Harrington Planer.
1—36x36x18 ft. Sellers Planer.
1—36x36x20 ft. N. Y. Steam Engine Co. Planer.
1—16x18″ Lathe & Morse Crank Planer.
2—15″ Hendey Shapers.
1—15″ Youngson Shaper.
1—15″ Smith and Mills Shaper.
1—10″x5′ Prentice Engine Lathe.
1 each 14″ and 15″x6′ Ames Engine Lathe.
1—16x5 ft. Bullard Engine Lathe.
1—18x8 ft. L. W. Pond Engine Lathe.
1—24x8 ft. Phillips Engine Lathe.
1—24x14 ft. Lathe & Morse Engine Lathe.
1—38x14 ft. New Haven Engine Lathe.

AND MANY OTHERS.

We have all the best makes of New Tools. Send for Second-Hand List.



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SPRINGFIELD, OHIO.

Large Double Engines, Gas or Gasoline, for Driving Flouring Mills, Electric Light Plants, Etc. a Specialty.

10 to 200 Horse-Power.

All Engines will be furnished with our New Pneumatic Governor, insuring Regularity of Speed and Perfect Control

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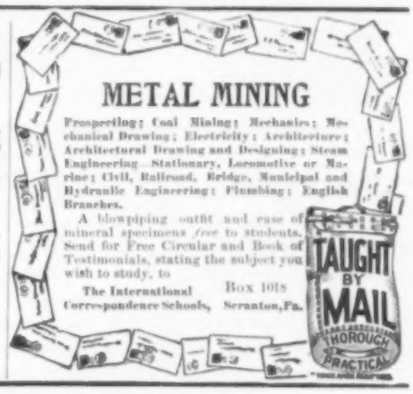
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EUREKA! FLUX ORES! RECLAIMED!

AN INVENTION OF INESTIMABLE VALUE TO THE MINERAL WORLD.

Now ready, machinery and process by which all small or flux ores can be prepared in any shape or size desired, ready for the cupola or furnace, at a very small cost.

Experts pronounce this invention most valuable, furnishing an inexpensive method for utilizing the soft and waste ores and thus reclaiming a large percentage of the most superior minerals.

For terms, machinery, territory, etc., address

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All Kinds of Pipe, Globe and Gate Valves, Fittings and Appliances for Steam, Gas, Water and Hydraulic Work.

Phosphor Bronze ("Elephant Brand") Castings, Coolers, Tuyeres and Cinder Notches for Blast Furnaces supplied promptly.

Rolling Mills, Steel Works, Blast Furnaces Coal and Coke Works, Power Houses for Electric Street Railways, etc., promptly fitted up by Experienced Workmen.

AIKEN Duplex and CRITCHLOW Valves, either three or four way, for operating Mill and Hydraulic Machinery of all kinds under any desired pressure, and Stop Valves for same.

Agents for the CAMERON STEAM PUMP, which is made in every possible variety, and suitable for all purposes to which Steam Pumps can be applied.

Nos. 108 to 118 Third Avenue, PITTSBURGH, PA.

The total weight of castings for this machine is 180 tons, the four columns weighing from 9½ to 12 tons each. The low-pressure cylinder weighs 12 tons.

EXCURSION RATES.

To Pittsburg, Washington, St. Louis, Chicago and Elsewhere via Pennsylvania Short Lines.

Special excursion tickets will be sold via Pennsylvania Short Lines as follows:

To Pittsburg, May 24, 25 and 26, account the National Prohibition Convention; good returning until May 30; also on June 6, 7 and 8 for the North American Saengerbund Convention; good to return until June 13.

To St. Louis, June 12, 13, 14 and 15, for the Republican National Convention; good returning until June 21 inclusive.

To Chicago, July 3, 4, 5 and 6, for the National Democratic Convention; good returning until July 12.

To Washington, D. C., July 4, 5, 6 and 7, account the Christian Endeavor Convention; valid to return July 15, with provision for extension of return limit until July 31.

Special local excursions will also be run during the season in addition to the foregoing. Please bear in mind the concessions in fare will be granted over the Pennsylvania Short Lines, the desirable route on which all the comforts of travel may be enjoyed. Applications for information addressed to passenger and ticket agents of the Pennsylvania System will be cheerfully and promptly answered. The person to see at Cleveland is C. L. Kimball, Ass't Gen. Pass. Agt., 149 Superior cor. Bank.

THE Niles Tool Works, Hamilton, O., has just completed fitting with machinery, tools, etc., the new boiler shops of John Mohr & Son, at South Chicago, Ill.

Prohibition National Convention Excursions to Pittsburg.

Excursion tickets to Pittsburg, account Prohibition National Convention, will be sold via Pennsylvania Lines May 24, 25

and 26; good returning until May 30. Particulars about rates and time of trains may be secured by addressing Pennsylvania Line Ticket Agents.

THE mills of the Whitaker Iron Co., at Wheeling, have closed down for the present, for lack of orders.

Christian Endeavor Washington Excursions.

Low rate tickets to Washington account Christian Endeavor Convention will be sold via Pennsylvania Short Lines July 4, 5, 6 and 7; good to return until July 15, with privilege to extend limit until July 31. See Pennsylvania Line Ticket Agents for details.

THE Sloss Iron & Steel Co., of Birmingham, Ala., is repairing its No. 4 furnace at North Birmingham, and making some substantial improvements. It will require about 60 days to complete the work. Furnace No. 3 continues in steady operation.

Pittsburg Saengerfest Excursions.

June 6, 7 and 8, are dates upon which excursion tickets to Pittsburg will be sold via Pennsylvania Lines for the North American Saengerfest. Return limit, June 13.

HALF rate to Cleveland and return via Cleveland Terminal & Valley R. R., account M. E. General Conference. Tickets on sale April 29, 30, May 1 and 12, 1886; good going date of sale, good returning within five days including day of sale. Tickets sold on the above dates will be available for further extension of return limit to June 2 inclusive by depositing same with joint agent at Cleveland within the five-day limit. Tickets at the same rate will also be sold on Saturdays, May 9, 16 and 23, good returning to and including the following Monday, giving Saturday, Sunday and Monday of each week at the Conference.

St. Louis Excursions for Republican National Convention

June 12, 13, 14 and 15, via Pennsylvania Lines; good returning until June 21. Rates and time of trains may be obtained of Pennsylvania Line Ticket Agents.

THE Circuit Court at Philadelphia has discharged the receivers of the Cumberland Steel & Tin Plate Co., of Cumberland, Md. The business will now be conducted by A. C. Dickey as vice-president and general manager.

Democratic National Convention Excursions to Chicago.

Tickets to Chicago will be sold at reduced rates via Pennsylvania Lines July 3, 4, 5 and 6; good returning until July 12; details may be obtained by applying to Ticket Agents of Pennsylvania Lines.

THE Sharpsville, Pa., furnace, operated last year by Corrigan, McKinney & Co., is still out of blast. Negotiations are in progress for a new lease to the same company.

Steam Yachts and Marine Machinery,

Also Towing Launches built by Marine Iron Works, Clybourn and Southport avenues, Chicago. Free illustrated catalogue. Write them for it.—*Adv.*

An unusual opportunity for the profitable investment of from $5,000 to $10,000 is offered to acceptable party. Active or silent. Address for interview,

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Fan System Heating and Ventilation.
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Hoisting, Crushing AND Mining Machinery.
EARLE C. BACON,
ENGINEER,
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WORKS:
Farrel Foundry & Machine Co. and Pacific Iron Works.
BACON'S
HOISTING ENGINES
For Every Possible Duty.
MINE CARS, SKIPS and MINE EQUIPMENT.

"FARREL'S" (Blake Pattern)
ORE AND ROCK **CRUSHERS**
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COMPLETE HOISTING, CRUSHING AND MINING PLANTS OUR SPECIALTY FOR OVER 20 YEARS, AND IN USE IN ALL PARTS OF THE WORLD.
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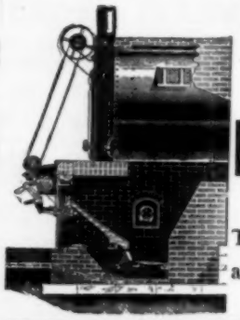
THE UPSON NUT CO., Manufacturers of Nuts Washers, Carriage, Machine, Plow, and Elevator Bolts, Coach Screws, etc.

N. W. TAYLOR. H. H. CAMPBELL.



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648 Broadway, CLEVELAND, O.
SOLE MANUFACTURERS OF THE
Brightman Mechanical Stoker
FOR STEAM BOILERS.
THE MOST ECONOMICAL IN FUEL
and the Best Device in the World for Preventing Smoke.
Send for Catalogue "A."

FRASER & CHALMERS
Chicago, Ill., U. S. A.
Engines and Steam Plant,
ALSO
CAST STEEL CUT GEARS
Much Superior to Cast Iron.
MAKERS OF
John Walker's Differential Cable Drums.

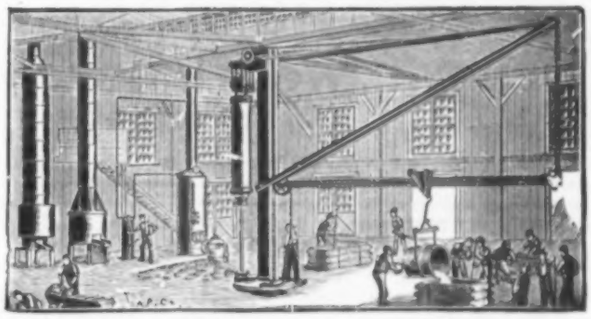
THE FINISHED STEEL CO
YOUNGSTOWN, OHIO
MFR'S OF **POLISHED SHAFTING**

Puddlin's Played out, Steel, Sir, Steel!

That's all you know about it. Suppose you go to Reading and see the new puddle mill the Reading Iron Co. is just starting, and maybe you'll change your mind. This wide-awake company has just finished the finest muck bar mill you will see in any country, and are completing right along side of it an equally fine skelp mill.

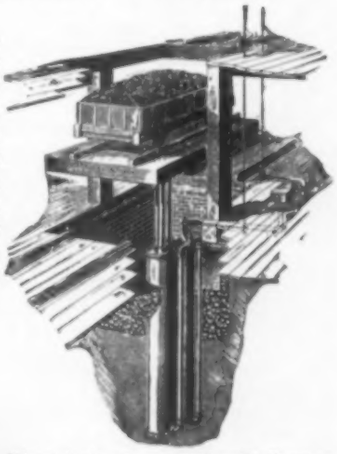
And both mills will handle every pound of their output with RIDGWAY STEAM-HYDRAULIC CRANES. They have used these cranes at their other mills and know something of their excellence.

We are equipping other such mills with these cranes and how in the world you expect to compete with such mills with your hand power, main strength and awkwardness rigging we cannot understand.



5-ton Steam-Hydraulic Crane in a Foundry.

In one of the many mills where Ridgway Cranes are used, one of these cranes, a man and boy both weigh and load 200 tons of rolled iron a day, and this from the ground level up over the sides of high gondolas. The scales are fastened to the crane and weighs as it lifts. Say, what does it cost you to weigh and load your output? And it isn't 200 tons per day either. The Ridgway Crane is a Godsend to every mill and if you but knew it, you can not afford to be without one a single day. At a mere nominal cost we give you a perfect hydraulic system. All you have to do is to attach to your ordinary steam supply and that's all there is of it. No freezing, don't get out of order, requires no attention from one year's end to the other. We have principally shouted this crane at the foundryman, but the rolling mill man and the blast furnace man have been getting them right along and are as enthusiastic over them as anybody.



Direct Acting Steam-Hydraulic Elevator.

"PLEASE TAKE THE ELEVATOR."

There is None So Good.

CRAIG RIDGWAY & SON, COATESVILLE, PA.

The Kellogg Weldless Tube Co.,

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MANUFACTURERS OF

Seamless Steel Tubes,

For Hydraulic Tubes, Jacks, Presses and Hoists, Lathe Spindles, Bicycle Hub Stock Projectiles, Hollow Shafting, Shells for Carbonic Acid and other Gases, Piston and Valve Rods, Axles, Bolts and Columns, Working Barrels, Roller Bearings, Bushings, Couplings, Boiler Tubes and other purposes where

Strength, Uniformity and Durability

ARE REQUIRED.

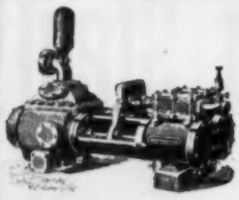
Our tubes are hot drawn, without weld or seam; from the best quality of steel, in lengths from 8 to 25 feet, and of any degree of hardness, from .08 to .60 carbon —They are equal in every respect, except finish, to cold drawn tubes and are offered at a much lower price.

For special work, requiring extremely low sulphur and phosphorus, we are prepared to guarantee a maximum of

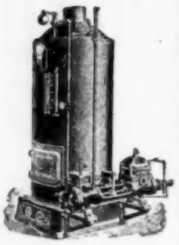
.020 SULPHUR and .015 PHOSPHORUS.

The following Sales Agencies will be pleased to supply any additional information that may be desired, viz:

Kellogg Weldless Tube Co.,
45 Milk Street, Boston.
Wm. J. Haines & Co.,
906 Filbert Street, Philadelphia.
Henry L. Coe,
727 Garfield Bldg., Cleveland.
Kellogg Weldless Tube Co.,
New York City.
M. T. Miles & Son,
317 and 318 Western Union Bldg., Chicago.
C. R. Talbot & Co.,
9 and 10 Wiggins Blk., Cincinnati.



WORTHINGTON STEAM... PUMPS...



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Link Belt Machinery Co.

ENGINEERS, FOUNDERS, MACHINISTS.

CHICAGO, U. S. A.

Malleable Iron Buckets of approved pattern and weight. Elevators and Conveyors. Electrical Mining Machinery. Water Elevators, Shafting, Pulleys, Gearing, Friction Clutches, Rope Sheaves, Etc.

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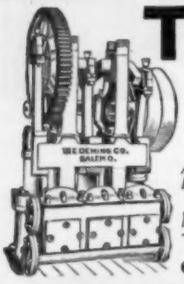

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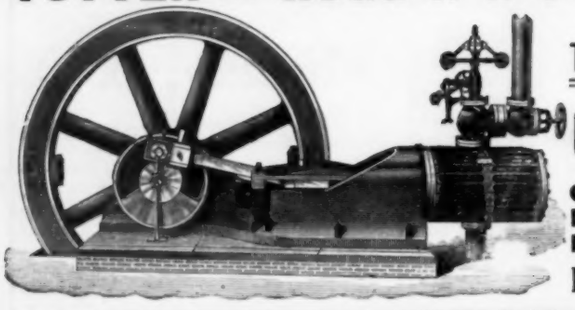

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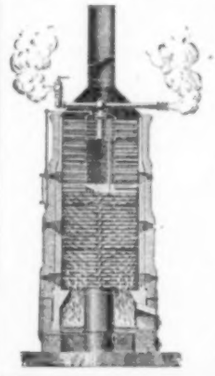

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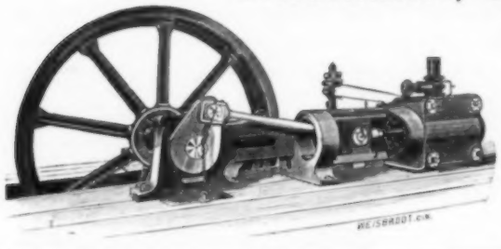

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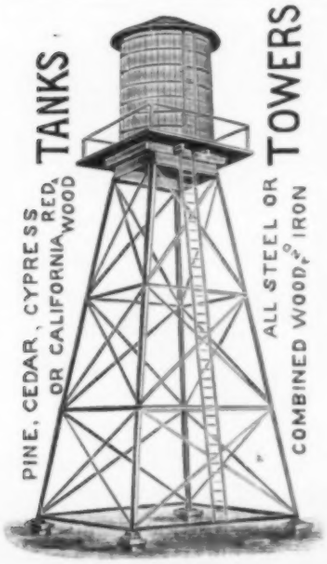

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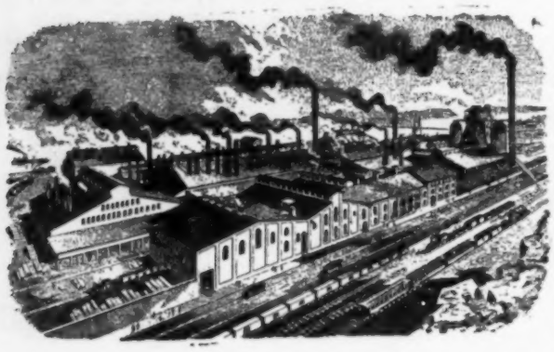

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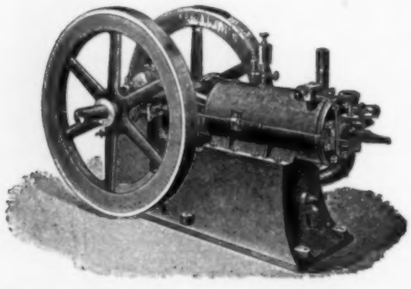

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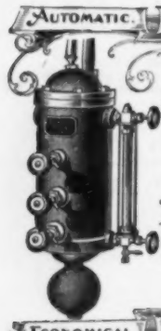

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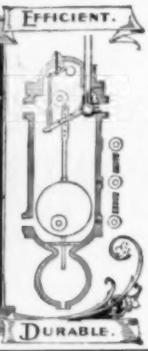

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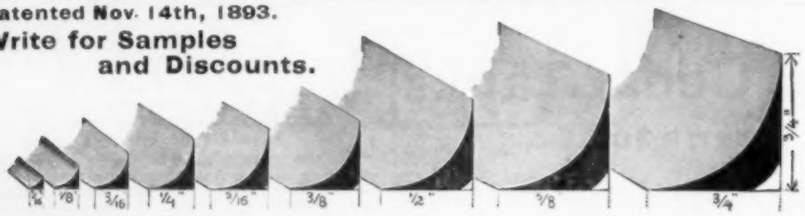

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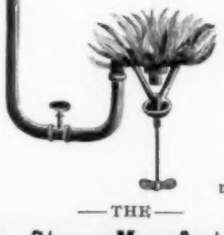

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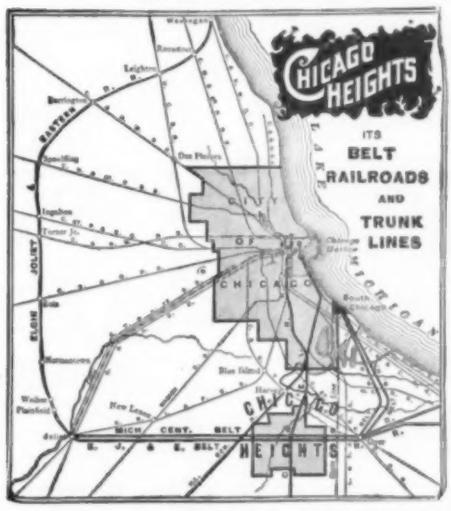

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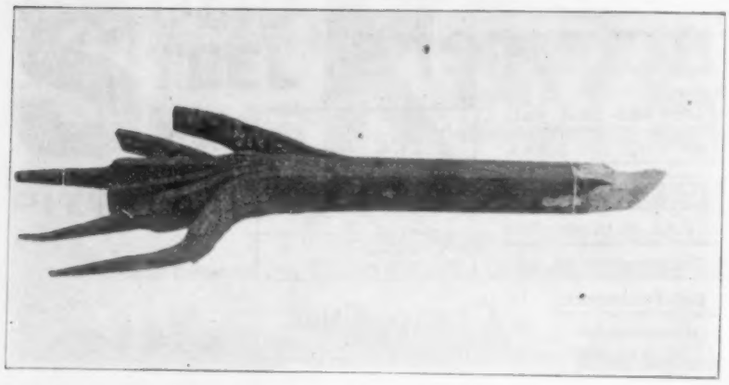

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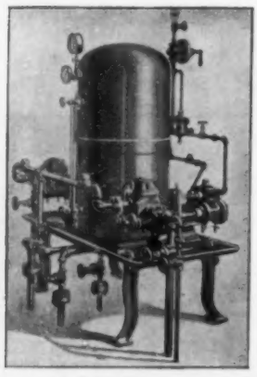

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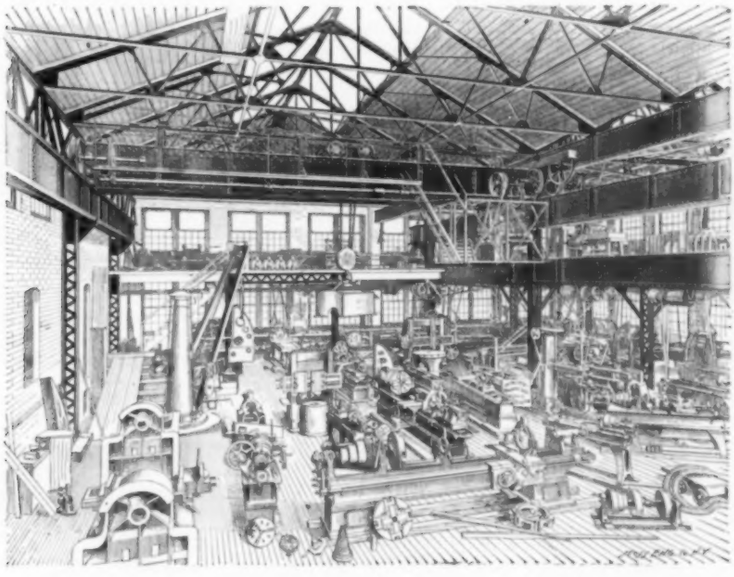

The above illustration is taken direct from a photograph and shows the interior of a Machine Shop designed and built by us for The Bridgeport Machine Tool Co., at Bridgeport, Conn. The building consists of two parts, each 40 feet in width. That shown in the immediate fore-ground being one story high for Erecting Room, while that portion of the building shown on the right is two stories high—light work being done on the second floor.

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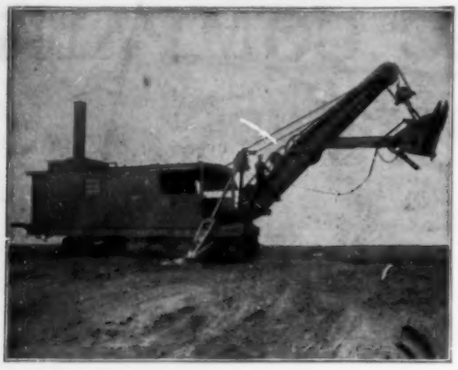

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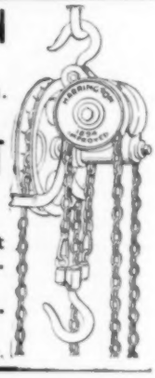

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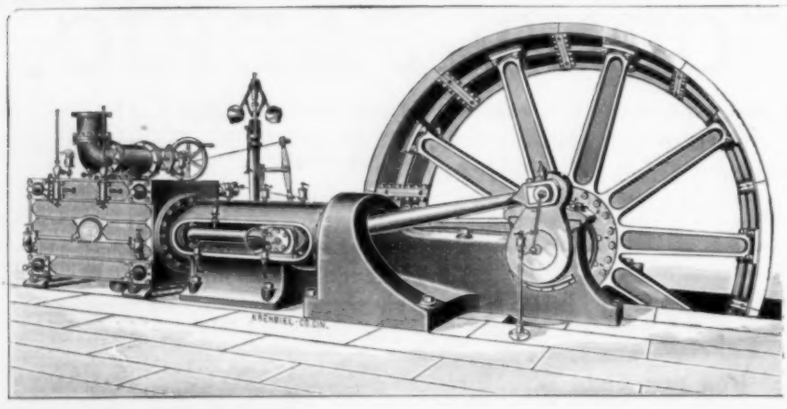

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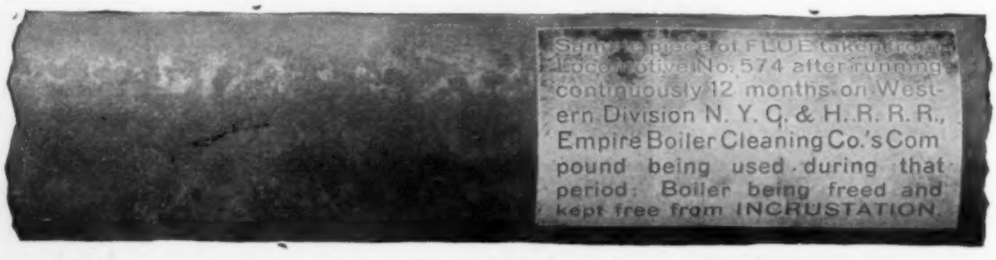
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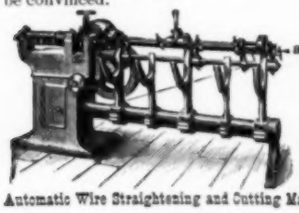

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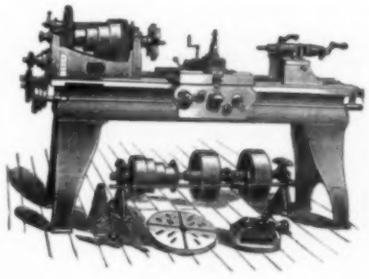

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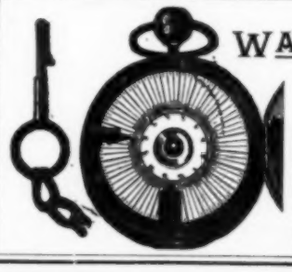

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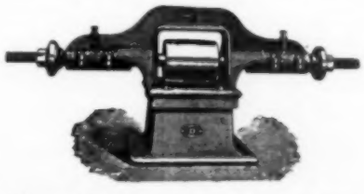

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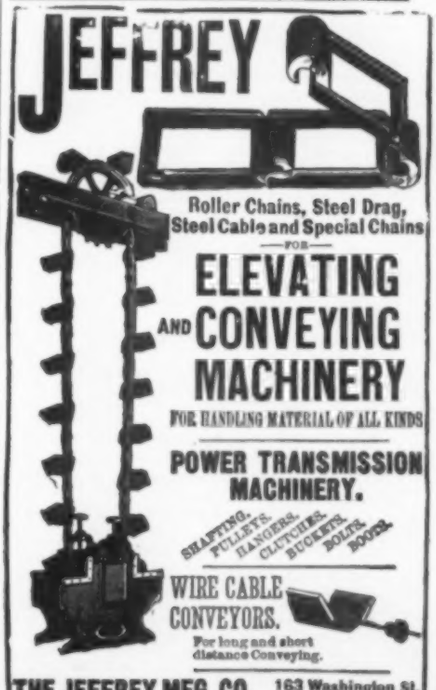

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SAN FRANCISCO, Mills Building.
WASHINGTON, D. C., 1333 F. St. N.
AHEARN & SOPER, OTTAWA, CANADA.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co. Chicago, Ill.

Lathes—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati
U. Baird Machinery Co., Pittsburg, Pa.
The Wright Co, Lowell, Mass.
Springfield Machine Tool Co., Springfield, O.

Machinists' Tools and Supplies—
Prentiss Tool & Supply Co., Chicago, Ill.
H. Bickford, Lakeport, N. H.
Davis & Egan Machine Tool Co., Cincinnati, O.
C. H. Besly & Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
U. Baird Machinery Co., Pittsburg, Pa.
The L. S. Starrett Co., Athol, Mass.
Skinner Chuck Co., New Britain, Conn.
Bertsch & Co., Cambridge City, Ind.
Lodge & Shipley Machine Tool Co., Cincinnati
C. H. Haeseler & Co., Philadelphia, Pa.
Springfield Machine Tool Co., Springfield, O.

Machine Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Hamilton Fdy. & Machine Co., Hamilton, O.
Springfield Machine Tool Co., Springfield, O.
Atwood & M'Caffrey, Pittsburg, Pa.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Metal Bearings—
North American Metaline Co., Long Island City, N. Y.

Metallic Lath—
The Cincinnati Corrugating Co., Piqua, O.

Metal Saws—
Q. & C. Co., Chicago, Ill.

Milling Machines—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.

Mining Machinery—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O
Vulcan Iron Works Co., Toledo, O.
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Link-Belt Machinery Co., Chicago, Ill.
Earle C. Bacon, New York City.
Fraser & Chalmers, Chicago.

Mining Schools—
Michigan Mining School, Houghton, Mich.

Motors—
Westinghouse Electric & Mfg. Co., Pittsburg.
General Electric Co., Scheuectady, N. Y.

Molding Sand—
Ohio Sand Co., Conneaut, O.

Oilless Bearings—
North American Metaline Co., Long Island, City, N. Y.

Oil Burners—
W. S. Rockwell & Co., New York City.

Oil Cups—
C. H. Besly & Co., Chicago, Ill.

Oil Pumps—
C. H. Besly & Co., Chicago, Ill.

Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.

Packing—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Paint—
Iron Clad Paint Co., Cleveland.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York City.

Pattern Leather Fillet—
Canton Leather Filiet Co., Canton, O.

Pattern Works—
Gobeille Pattern Co., Cleveland, O.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago.

Pipe Covering—
C. H. Besly & Co., Chicago, Ill.

Planers—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.
U. Baird Machinery Co., Pittsburg, Pa.

Plates—
Pittsburg Steel & Iron Mfg. Co., Pittsburg, Pa.

Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.

Portable Drills—
C. H. Haeseler & Co., Philadelphia, Pa.

Power Presses—
Springfield Machine Tool Co., Springfield, O.

Portable Forges—
Buffalo Forge Co., Buffalo, N. Y.
Cady Mfg. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.

Presses—
Springfield Machine Tool Co., Springfield, O.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.

Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
Link-Belt Machinery Co, Chicago, Ill.

Pulley Blocks—
Moore Mfg. & Foundry Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.

Pumps (Steam)—
W. G. & G. Greenfield, East Newark, N. J.
Battle Creek Steam Pump Co., Battle Creek, Mich.
Deming Co., Salem, O.
The Edward P. Allis Co., Milwaukee, Wis.
Atwood & M'Caffrey, Pittsburg, Pa.
Henry R. Worthington, Brooklyn, N. Y.
Fraser & Chalmers, Chicago.

Pump Regulators—
Valley Iron Works, Williamsport, Pa.

Pyrometers—
Edward Brown, Philadelphia, Pa.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.

Retort Coke Ovens—
Semet-Solvay Co., Syracuse, N. Y.

Rock Breakers—
American Hoist & Derrick Co., St. Paul, Minn.

Rock Drills—
Rand Drill Co., Chicago, Ill.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg I. & S. F'dry Co., Pittsburg, Pa.

Rolling Mill Supplies—
Atwood & M'Caffrey, Pittsburg, Pa

Rolls—
Samuel Tretheway & Co., Pittsburg, Pa.

Roofs—
Berlin Iron Bridge Co., East Berlin, Conn.
The Cincinnati Corrugating Co., Piqua, O.

Roofing Plates—
Morton Tin Plate Co., Cambridge, O.
The Cincinnati Corrugating Co., Piqua, O.

Rust Preventatives—
Otto Goetze, New York City.

Sand and Chill Rolls—
The Lloyd-Booth Co., Youngstown, O.

Sand Blast Machines—
Ward & Nash, Chicago, Ill.

Saws—
Peter Gerlach & Co., Cleveland.

Schools—
International Correspondence Schools, Scranton, Pa.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.

Scrap Iron & Steel—
Klein & Cohn, Cincinnati, O.

Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O

Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.

Semi-Steel—
McDowell Steel Co., Chicago, Ill.

Shapers—
Springfield Machine Tool Co., Springfield, O.

Shafting—
Finished Steel Co., Youngstown, O.

Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Long & Allstatter Co., Hamilton, O.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
Berger Bros., Philadelphia, Pa.
Ætna-Standard Iron & Steel Co., Bridgeport, O
The Cincinnati Corrugating Co., Piqua, O.

Smoke Consumers—
American Smokeless Furnace Co., Cleveland, O.
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.

Special Machinery—
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Edwin Harrington Son & Co., Philadelphia.

Skylights—
Translucent Fabric Co., Quincy, Mass.

Stamping and Punching—
Cady Mfg. Co., Cleveland, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill

Steam Packing—
C. H. Besly & Co., Chicago, Ill.

Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O
Vulcan Iron Works Co., Toledo, O.

Steam Specialties—
C. H. Besly & Co., Chicago, Ill.

Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.

Steel Castings—
Wm. Jessop & Sons, Ltd., New York, N. Y.
The Johnson Co., Johnstown, Pa.
McDowell Steel Co., Chicago, Ill.

Steel Knives—
Samuel Tretheway & Co., Pittsburg, Pa.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Cambria Iron Co., Johnstown, Pa.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.

Steel Shafting—
Finished Steel Co., Youngstown, O.

Steel Tanks—
Berlin Iron Bridge Co., East Berlin, Conn.

Stokers—
Playford Stoker Co., Cleveland, O.

Structural Engineers—
Berlin Iron Bridge Co., East Berlin, Conn.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.
Central Iron & Steel Co., Brazil, Ind.

Tanks—
S. Freeman & Sons Mfg. Co., Racine, Wis.
Enterprise Boiler Co., Youngstown, O.

Tapping Machines—
Harvey Hubbell, Bridgeport, Conn.

Telephones—
Universal Telephone Co., Indianapolis, Ind.

Time Detector—
Nanz & Co., New York.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tin Plate—
Morton Tin Plate Co., Cambridge, O.
Atlanta Steel & Tin Plate Co., Atlanta, Ind.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.

Torches—
Dangler Stove & Mfg. Co., Cleveland, O.

Tool Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.
C. H. Besly & Co., Chicago, Ill.

Tube Welding—
S. Fix Sons, Cleveland.

Twist Drills—
C. H. Besly & Co., Chicago, Ill.

Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Ventilating Fans—
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.

Watchman's Time Detector—
Nanz & Co., New York.

Water Tanks—
Williams Mfg. Co, Kalamazoo, Mich.

Welding Compound—
Cornelius S. Mitchill, New York City.
E. G. Newhall & Co., Detroit, Mich.

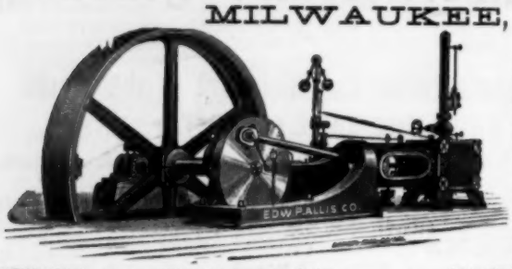
Wire Nails—
Salem Wire Nail Co., Salem, O.

Wire Rope—
American Hoist & Derrick Co., St.
Roberts Steel Chain Belting Co., Pittsburg

Wire Machinery—
Cady Mfg. Co., Cleveland, O.
John Adt & Son, New Haven Conn.

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



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Blowing Engines, Hoisting Engines, Pumping Engines, Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills, Concentrators, General Mining, Milling and Smelting Machinery.

Reynolds Patent Vertical Boilers.

Reynolds Corliss Engines.

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CHICAGO, Room 509, Home Ins. Bldg
MINNEAPOLIS, Room 416, Corn Exchange.
DENVER, 1316 18th Street.
SAN FRANCISCO, 31 Main Street.
PITTSBURG, 702 German National Bank Bldg.
SALT LAKE CITY, Desert Bank Bldg.
KANSAS CITY, Armour Bldg.

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The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

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IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$4.50@4.75
No. 1 Bessemer hematite	4.00@4.25
Hematites No. 1 non-Bessemer	2.25@2.75
No 1. Specular, non-Bessemer	2.75@3.25

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$13 25@13 50
No. 1 Strong Foundry	12 75@13 00
No. 2 Strong Foundry	12 00@12 50
No. 1 Gray Forge, red short	11 25@11 50
No. 2 Gray Forge, neutral	10 75@11 00
No. 1 American Scotch	13 00@13 25
No. 2 American Scotch	12 25@12 50
Lake Superior Charcoal	13 50

PITTSBURG:

No. 1 Foundry	$12 75@13 25
No. 2 Foundry	12 00@12 25
Gray Forge	11 00@11 25
White and Mottled	10 25
Warm Blast Charcoal	15 00@16 00
Cold Blast Charcoal	22 00
Bessemer	13 25@13 50

CHICAGO (reported by our representative:)

Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	12 25@12 50
Local Coke Foundry No. 2	11 75@12 00
Local Coke Foundry No. 3	11 00@11 50
Local Scotch Foundry No. 1	12 25@12 50
Local Scotch Foundry No. 2	11 75@12 00
Local Scotch Foundry No. 3	11 00@11 50
Southern Coke No. 1	12 10@12 35
Southern Coke No. 2	11 60@11 85
Southern Coke No. 3	11 10@11 60
Southern No. 1 Soft	11 60@11 85
Southern No. 2 Soft	11 35@11 50
Southern Silveries No. 1	11 85@12 35
Southern Silveries No. 2	11 60@11 85
Jackson Co. Silveries	14 50@16 00
Ohio Silveries No. 1	15 00@15 50
Ohio Silveries No. 2	14 50@15 00
Ohio Strong Softeners	15 00@15 50
Alabama Car Wheel	16 85@17 35
Malleable Bessemer	13 25@13 50
Coke Bessemer	13 00@14 00

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$11 00
Southern Coke No. 2 and No. 1 Soft	10 50
Hanging Rock Coke, No 1	12 50@13 50
Hanging Rock Charcoal No. 1, Fdy	16 00@17 00
Tennessee Charcoal No 1	13 00@14 00
Jackson County Silvery No 1	14 00@14 50
Southern Coke, Gray Forge	9 50
" " Mottled	9 50
Standard Alabama Car Wheel	15 00@16 00
Tennessee " "	14 00@15 00
Lake Superior " "	15 25@15 50

BUFFALO:

No. 1 Foundry Strong Coke Iron Lake Superior Ore	$13 00@13 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	12 50@12 75
Ohio Strong Softener No. 1	13 00@13 50
Jackson Co. Silvery No. 1	15 25@15 50
Lake Superior Charcoal	13 50@14 00
Southern Soft No. 1	12 15
Hanging Rock Charcoal	17 00

ST. LOUIS (reported by Rogers, Brown & Mercham):

Southern Coke No 1	$11 50
Southern Coke No. 2	11 00
Southern Coke No. 3	10 50
Southern Gray Forge	10 00
Southern Charcoal No. 1	15 00
Missouri Charcoal No. 1	14 00@15 00
Ohio Softeners	16 00
Lake Superior Car Wheel	15 00
Southern Car Wheel	16 25

OLD RAILS AND SCRAP METAL.

	GROSS TONS
Old iron rails	$16 50
Old steel rails	12 50
Old car wheels	13 00
	NET TONS
No. 1 R. R. wrought scrap	$12 75
Mill scrap	10 00
No. 1 Machine cast scrap	10 00
Iron axles	17 50
Axle turnings	9 00
Wrought turnings (free from cast)	8 00
Cast borings	7 00
Uncut wrought iron boilers	4 00
Steel boiler plates	10 00
Grate bars	6 75
Pipes and flues (clean)	10 00
Tank iron	10 00
Hoop and band iron	7 00
Sheet iron	6 50
Wrought drillings	7 50
Malleable iron	10 00

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.54c
Angles	1.34c@1.39c
Tees	1.49c
Universal Plates	1.45c
Sheared Plates	1.50c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 30
4½ to 6 by ⅜ to 1 inch	1 35
1½ to 6 by 1¼ to 2 inch	1 35
1¼ & 1¼ by ⅜ to ¾ inch	1 20
1 & 1¼ by ⅜ to ¾ inch	1 20
¼, ⅝, ⅞, by ⅜ to ⅝ inch	1 20

Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas.
THE CADY MFG. CO.
18, 20 and 22 Johnson St., CLEVELAND, O.

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PERFORATED METALS
OF ALL KINDS FOR
MILLING MINING AND AGRICULTURAL MACHINERY,
PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.
LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.
THE ROBERT AITCHISON. PERFORATED METAL CO.,
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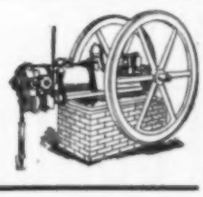
WESTMORELAND FIRE BRICK CO.
MANUFACTURERS OF HIGH GRADE FIRE BRICKS.
PITTSBURG, PA.
Works and Mines, Westmoreland, Pa.

DIXON'S GRAPHITE PAINT
FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL.
Tin roofs well painted have not required repainting for 10 to 15 years.
If you need any paint it will pay you to send for circular.
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

SMALL DYNAMOS
For Incandescent Lighting,
In Factories, Mills, etc., at a Reasonable Price.
If you have power put in your own lighting plant. Write for our Catalogue.
STAR DYNAMO CO., Jefferson City, Mo.

POWER From **GAS OR GASOLINE.**
No Steam, Coal, Ash, Gauges, Engineer nor Danger.
From 1 to 250 horse-power. } Can be Used in City or Country.
THE OTTO GAS ENGINE WORKS, Inc.
33d and Walnut Sts., PHILADELPHIA, PA.
S. M. York, 42 S. Water St., Cleveland Agent. Over 45,000 Sold.



IRON CLAD PAINT CO.
Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND OHIO.

ORDER DIRECT FROM THE
Iron Clad Paint Co.
And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

Trade Mark Patented

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.
FURNISHED both Dry and Ground in Oil
USED BY NEARLY ALL THE RAILROADS.

Round and Square.

1 to 1⅜ inch	1 10
2 to 2⅜ inch	1 30
2⅜ to 3¼ inch	1 25
3⅜ to 4 inch	1 60
4¼ to 4½ inch	2 30
4¾ to 5 inch	2 40

Oval.

⅜ to 1¼ inch	1 30
½ to ¾ inch	1 30
⅝	1 50
⅜	1 70

Half Oval and Half Round.

1⅛ to 3 inch	1 65
⅜ to 1⅛ inch	1 45
½ to ¾ inch	1 70
⅝	1 85
⅜	2 90

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 20
1 to 1¾ by ¼ and 5-16 inch	1 25
⅜ to ⅝ by ¼ and 5-16 inch	1 35
½ to ⅝ by ¼ and 5-16 inch	1 60

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 35
1 7-16 to 2, No. 17, 18 and 19	1 40
1 7-16 to 2, No. 20	1 50
1 7-16 to 2, No. 21	1 60
1 7-16 to 2, No. 22	1 70
1⅛ to 1⅜, No. 13, 14 and 15	1 40
1⅛ to 1⅜, No. 16, 17 and 18	1 45
1⅛ to 1⅜, No 19 and 20	1 50
1⅛ to 1⅜, No. 21	1 60
1⅛ to 1⅜, No. 22	1 70
15-16 and 1 inch, No. 13, 14 and 15	1 35
15-16 and 1 inch, No. 16, 17 and 18	1 50
15-16 and 1 inch, No. 19 and 20	1 60
15-16 and 1 inch, No. 21	1 70
15-16 and 1 inch, No. 22	1 80
⅝, No. 13, 14 and 15	1 60
⅝, No. 16, 17 and 18	1 70
⅝, No. 19 and 20	1 80
⅝, No. 21	1 90
⅝, No. 22	2 00
13-16, No. 13, 14 and 15	1 70
13-16, No. 16, 17 and 18	1 80
13-16, No. 19 and 20	1 90
13-16, No. 21	2 00
13-16, No. 23	2 10
¾, No. 13, 14 and 15	1 80
¾, No. 16, 17 and 18	1 95
¾, No. 19 and 20	2 05
¾, No. 21	2 15
¾, No. 22	2 25
11-16, No. 13, 14 and 15	2 05
11-16, No. 16, 17 and 18	2 10
11-16, No. 19 and 20	2 20
11-16, No. 21	2 30
11-16, No. 22	2 40
11-16, No. 23	2 50
⅞, No. 13, and 15	2 10
⅞, No. 16, 17 and 18	2 20
⅞, No. 19 and 20	2 30
⅞, No. 21	2 40
⅞, No. 22	2 50
⅞, No. 23	2 60
9-16, No. 13, 14 and 15	2 30
9-16, No. 16, 17 and 18	2 40
9-16, No. and 20	3 50
9-16, No. and	1 60
9-16, No. 221	2 70
9-16, No. 22	1 80
7-16 ad ½ inch, No. 13, 14 and 15	3 50
7-16 and ½ inch, No. 16, 17 and 18	2 60
7-16 and ½ inch, No. 19 and 20	2 70
7-16 and ½ inch, No. 21	2 80
7-16 and ½ inch, No. 22	2 90
7-16 and ½ inch, No. 23	3 00
½, No. 13, 14 and 15	3 00
½, No. 16, 17 and 18	3 10
½, No. 19 and 20	3 20
½, No. 21	4 50
½, No. 22	3 60
½, No. 23	3 75

Light Band.

1⅛ to 6 by ⅛ to 3-16 inch	1 60
1⅛ to 6 by Nos. 11 and 12	1 65
1 to 1¾ by ¼ to 3-16 inch	1 65
1 to 1¾ by Nos. 11 and 12	1
⅜ and 13-16 by ⅛ to 3-16 inch	1
⅜ and 13-16 by Nos. 11 and 12	1 75
⅛ and 11-16 by ¼ to 3-16 inch	1 90
⅛ and 11-16 by Nos. 11 and 12	1 95
⅜ and 9-16 by ⅛ to 3-16 inch	2 05
⅜ and 9-16 by Nos. 11 and 12	2 10
⅛ by ⅜ to 3-16 inch	2 20
¼ by Nos. 11 and 12	2 25

Wagon Box Iron.

⅛ inch, beveled edge, by Nos. 11 and 12	1 50
⅛ inch, " " " " 13 and 14	1 60
⅛ inch, " " " " 11 and 12	1 65
⅛ inch, " " " " 13 and 14	1 75

Sheet Iron.

No. 10	1 45
No. 12	1 55
No. 14	1 65
No. 15-17	1 75
No. 18	1 90
No. 20	2 05
No. 22-24	2 15
No. 25 26	2 25
No. 27	2 35

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 45
Shell	1 60
Flange	1 70
Marine Flange	2 00
Fire Box	2 50

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs.
1 to 2 in. inclusive	08
9-16 to ⅞ in. "	08

ÆTNA-STANDARD IRON AND STEEL COMPANY,

BRIDGEPORT, OHIO,

MANUFACTURERS OF

TIN AND TERNE PLATE, Iron and Steel Plates and Sheets, Plain Black, Painted, Corrugated and other forms of ROOFING, SIDING and CEILING. Patent Leveled Galvanized Sheets, BARS, Light Section Rails, ANGLES, Tees, Channels, and other Miscellaneous Bars and SHAPES.

WITH SUCH DIVERSITY OF PRODUCT,

SPECIAL ADVANTAGES are offered buyers of mixed lots, effecting saving in freight charges and by reason of our LARGE STOCKS, securing **PROMPT SHIPMENT.**

INQUIRIES INVITED AND CATALOGUES MAILED ON APPLICATION.

ROBERTS STEEL CHAIN BELTING CO., Pittsburg, Pa.

Elevating and Conveying Machinery

For Handling all kinds of materials.

Special Wrought and Steel Chains of every description; Coil and Cable Chains; Chain Haulages for Coal Mines; Sprocket Wheels; Complete Coal and Ashes Handling Plants; Wire Rope Haulages and Wire Rope.

W. H. COFFMAN COKE CO.

BLUEFIELD, W. VA.

GENERAL FACTORS AND SHIPPERS OF

POCAHONTAS FLAT-TOP COKE.

So low in ash that it requires no fluxing for foundry purposes. Our foundry and furnace coke was awarded the first premium at the World's Fair in 1893.

AVERAGE ANALYSIS OF COKE.

Moisture	00.196	Sulphur	00.677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00.494		

Foundry, Furnace and all sizes of crushed coke. Guaranteed lower in Sulphur than any other commercial coke

STEEL CASTINGS

FROM 10 LBS. UPWARD.

Made from Best Open-Hearth Steel.

ALSO SAND ROLLS AND CAST-IRON PINIONS.

SEND FOR ESTIMATES.

THE JOHNSON COMPANY, Johnstown, Pa.

GARDEN CITY FOUNDRY CO.

INCORPORATED.

Successors to TURNER, DICKINSON & CO.

Armitage and Central Avenues, Station G, Chicago, Ill.

FRICTION CLUTCHES, HANGERS, PILLOW BLOCKS & PULLEYS.

Large Stocks on Hand. Shipments Promptly Made.

We Claim The Following Merits for **Jenkins Bros.' Valves**

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark,

JENKINS BROTHERS, NEW YORK, PHILADELPHIA, CHICAGO, BOSTON.

7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅜ to 4 in.	.09½
⅜ to 11-16 and 4⅛	.10
⅛ to 6 in.	.10½
¾ to 9-32 and 6⅜ to 7 in.	.11
7 ½ in	.13

Flats.

	cts. ℔s
2 to 9-16 in. wide by 2 to ⅜ thick	.8

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 50
Open-hearth Tire	"	1 50
Open-hearth Spring	"	2 20
Sleigh Shoe	"	1 90
Toe Calk	"	2 10
Cutter Shoes, tapered and bent	"	2 20

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam	3 00

Wrought Pipe and Boiler Tubes.

Lap weld black, base	dis. 65
Butt " " "	dis.
Lap " galv. "	dis. 52½
Butt " " "	dis. 50
Boiler tubes 2¼" and smaller	dis. 62½
Boiler tubes 2½" and larger	dis. 65
Casing screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ lb 9@10
Wright's	℔ lb 12

Bellows.

Blacksmiths'	Hill's	dis 40
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 4(
Standard, oak tanned	dis 50&1(
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis
Horton's Universal	dis
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis
" " Gear Cutters	dis

Crowbars.

Cast Steel	℔ 3½
Iron, steel points	℔ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1⅛"	dis 50&10
Morse Taper and Straight Shank Larger than 1⅛"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

SHIFFLER BRIDGE COMPANY,

BUILDING DEPARTMENT.

SPECIALTIES: STEEL AND IRON BUILDINGS FOR ROLLING MILLS TIN PLATE PLANTS, STEEL WORKS, FOUNDRIES, FACTORIES, ROOF TRUSSES, GIRDERS, COLUMNS, BEAMS, CORRUGATED IRON, ETC.

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Branch Offices:
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65 Dexter Building, Chicago, Ill.
228 Lumber Exchange, Minneapolis, Minn.

CAMBRIA STEEL.

Steel Rails, Blooms, Billets, Bars, Axles, Angles, Channels, Forgings, Locomotive Car and Structural Steel.

CAMBRIA IRON COMPANY, S. W. Cor. 15th and Market Sts., opp. Penna. R. R. Station, Philadelphia; Chicago office, Western Union Building; New York office, (for Rails and Axles), 33 Wall St.; Cleveland office, Bourne, Fuller & Co. Works at Johnstown, Pa.

GAUTIER STEEL DEPARTMENT OF CAMBRIA IRON CO.,

JOHNSTOWN, PA.

MERCHANT BAR STEEL: Including Tire, Toe Calk, Machinery, Carriage Spring, Railroad Spring, Hoe, Rake, Fork, etc.
AGRICULTURAL STEEL AND SHAPES: Finger Bars, Knife Backs, Rake Teeth, Bundle Carrier Teeth, Tedder Forks and Springs, Spring Harrow Teeth, Harrow (Drag) Teeth, Seat Springs, etc.
PLOW STEEL: Flat and Finished Plow Shapes, Digger Blades, Slabs (Penn and Per-ot), Hammered Lay, Rolled Lay, etc.

Cold Rolled Steel Shafting. **Steel Harrow Discs.** **Cambria Link Barb Wire.**

New York Office,	Philadelphia Office,	Chicago Office,	Atlanta Office,
102 Chambers St.	611 Phila. Bourse,	209 Western Union Bldg.	325 Decatur st.

STUART FIRE BRICK CO.

MANUFACTURERS OF

Silica Brick

For Open-Hearth, Basic and Acid Steel Furnaces, Glass and Copper Tank Furnaces. Extra Shapes MADE TO ORDER.

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COMBINE SAFETY WATER TUBE BOILER
L. M. MOYES, MANUFACTURER, PHILADELPHIA, PA.

Waverley BICYCLES.

A POINTER TO DEALERS.

You have seen the words at the top of this ad. so often that they are engraved upon your mind. They are likewise engraved upon the mind of almost every individual who can read. When a person thinks of bicycles the first thing that flashes upon the mind is Waverley and that is the first wheel asked for. Do you realize the importance of being able to supply what a prospective buyer wants? Just consider it for a few moments, and then write us for terms.

INDIANA BICYCLE CO.,

INDIANAPOLIS, IND.
EASTERN DISTRIBUTING BRANCH.
339 BROADWAY, NEW YORK.

Emery.

	No. 4 to No. 54 46 gr.	150 gr.	Flour, C. F. F. FF.
Kegs, 25 lb	4½c	5 c	2½c
½ kegs 12½ lb	4½c	5¼c	2¾c
¼ kegs 6¼ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co. ..... dis 50@50&5
H. H. Barton ..... dis 50@50&5

Emery Wheels.

Detroit ..... dis 60@70
Norton's ..... dis 60@70
Grant ..... dis 60@70
Sterling ..... dis 60@70
Celluloid ..... dis 10&33⅓
Northampton ..... dis 50
Crystal ..... dis 65@70
Vitrified ..... dis 60@70
Vulcanite ..... dis 60&10
Hamden ..... dis 60&10@75
Cyclone ..... dis 60@60&10

Files.

Arcade ..... dis 60&10@60&10&10
Nicholson ..... dis 60&10@60&10&10
" X. F. ..... dis 25
Kearney & Foot ..... dis 60&10@60&10&10
Black Diamond ..... dis 60&10@60&10&10
McClellan ..... dis 60&10@60&10&10
Disston's ..... dis 65@70
Western ..... dis 70
Stub's ..... dis 25
Grobet's ..... dis 30
Reynolds Bros.' Hand Cut ..... dis 50
Industry File Works Hand Cut ..... dis 50

Hammers.

P. S. W ..... dis 40
Atha new list, Jan. 15, 1887 ..... dis 50
Heavy hammers and sledges under 5 lbs 12c
" " " " over 5 lbs 10c

Jack Screws.

Illinois Bolt Co. list ..... dis 75

Nuts and Washers.

Size of bolt inches	⅜	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	15⅝	11⅝	8⅛	6	5⅛	5⅛	
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, 25 lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887 ..... dis 85
Standard Penny Nails, 25 lb keg card rate
{ Car lots $2.25
{ Less than car lots $2.35

Oilers.

Zinc and Tin ..... dis 60
Brass and Copper ..... dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ⅌ doz ..... dis 10@10&10

Picks.

Railroads, 5 to 6 lbs ..... $12 dis 60
" 6 to 7 lbs ..... $13 dis 60

Pulleys.

Iron Pulleys, Walker List ..... dis 50
Medart Pulleys ..... dis 50
Split Wood Pulleys ..... dis 55@60

Pulley Blocks.

Moore's Anti-Friction Differential Chain Pulley Block ..... dis 20

Rivets.

Iron, Thousand, list November 1, 1894 ..... dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894 ..... dis 60@65
Copper ..... dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in ..... dis 50
Carpenters' " " " ..... dis 50
Morse " " " ..... dis 50
Pratt & Whitney " " new list ..... dis 10
Machine Screw Taps ..... dis 55
Pipe Taps to 2½ in ..... dis 70
Stay Bolt Taps ..... dis 25
Stove Bolt Taps ..... dis 55
Pulley Taps ..... dis 40

Vises.

Solid Box ..... dis 60
Parker's ..... dis 20@25
Prentiss ..... dis 20
Stephen's ..... dis 25@30
Barrett's ..... dis 30
Miller's Falls ..... dis 40
Merrill's ..... dis 15@20
Howard ..... dis 35

Wire.

New List, Apr. 9, 1894

Brass ..... dis 40
Copper ..... dis 40
Bright and annealed, Nos. 0@18 ..... dis 70&10@75
" " Nos. 19@26 ..... dis 75@75&5
" " Nos. 27@36 ..... dis 75&10&5
Coppered Nos. 0 to 18, market list ..... dis 70@70&5
Galvanized Nos. 0 to 18 " " ..... dis65&5
Tinned market Nos. 0 to 18 ..... dis 67½
Cast steel ..... dis 50
Tinned Broom Wire ..... dis 70&5@70&10
Annealed Fence, Nos. 8 and 9 ..... dis 75
Annealed Grape, Nos. 10 to 14 ..... dis 75
Stub's Steel Wire regular ..... 95c ⅌ lb dis 30

Wrenches.

Coe's genuine ..... dis 50
Girard Standard ..... dis 70&10
Agricultural ..... dis 75&10
Mechanic's ..... dis 55&10&5
Bemis & Call's Combination ..... dis 35
Donohue's Engineers ..... dis 20&10
Lamson & Sessions Engineers ..... dis 65
Billings & Spencer's Drop Forged ..... dis 25
William's " " ..... dis 25
Alligator " " dis40

Perforated Filter Press Plates.

THE HARRINGTON & KING PERFORATING CO. CHICAGO.

BRONZE SCREEN PLATES To withstand action of ACIDULATED WATERS.

PERFORATORS OF STEEL, IRON, COPPER, ZINC, BRASS AND TIN.

For use in GRAIN CLEANING AND MINING MACHINERY, WOOLEN, COTTON, PAPER AND PULP MILLS, RICE, FLOUR AND COTTON SEED OIL MILLS, SUGAR AND MALT HOUSES. DISTILLERIES, FILTER PRESSES. STONE, COAL, AND ORE SCREENS, BRICK AND TILE WORKS, FILTERS, SPARK ARRESTERS, GAS AND WATER WORKS, OIL, GAS AND VAPOR STOVES, COFFEE MACHINERY, ETC.

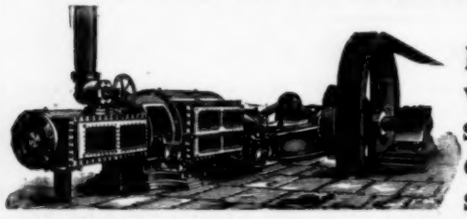
STANDARD SIZES PERFORATED TIN AND BRASS ALWAYS IN STOCK.

Main Office and Works, 222 to 240 No. Union St., Chicago, Ill., U. S. A. Eastern Office, No. 284 Pearl St., New York.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Williams Improved Vertical Engines

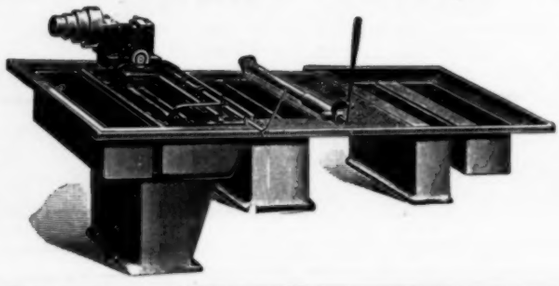
For Direct Electrical and all High Class Work.

39-41 Cortland St., N. Y. E. F. WILLIAMS.

1025 Monadnock B'ld'g, Chicago. ALBERT FISHER.

THE LLOYD-BOOTH CO., YOUNGSTOWN, OHIO.

Tinning MACHINERY.



Rolling Mills, Sand and Chill ROLLS.

ARE YOU LOOKING

FOR A CHANGE IN LOCATION?

If you are not satisfied with your present site, or if you are not doing quite as well as you would like to, why not consider the advantages of a location on the Illinois Central R. R. or the Yazoo & Mississippi Valley R. R.? These roads run through South Dakota, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Kentucky, Tennessee Mississippi and Louisiana, and possess

FINE SITES FOR NEW MILLS,
BEST OF FREIGHT FACILITIES,
CLOSE PROXIMITY TO
COAL FIELDS AND DISTRIBUTING CENTERS
AND
INTELLIGENT HELP OF ALL KINDS,
MANY KINDS OF RAW MATERIAL.

For full information, write the undersigned for a copy of the pamphlet entitled

100 Cities and Towns WANTING INDUSTRIES

This will give you the population, city and county debt, death rate, assessed valuation of property, tax rate, annual shipments, raw materials, industries desired, etc.

To sound industries, which will bear investigation, substantial inducements will be given by many of the places on the lines of the Illinois Central R. R., which is the only road under one management running through from the North-Western States to the Gulf of Mexico. GEO. C. POWER, Industrial Commissioner I. C. R. R. Co., 506 Central Station, Chicago. I-2-'94

STERLING EMERY WHEEL MFG. CO.

TIFFIN, O.

CORRESPONDENCE SOLICITED.

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The Geo. Worthington Co., Cleveland.
Somers, Fitler & Clarke, Pittsburg.

P. & B. Ruberoid Roofing is peculiarly adapted for Buildings of any character which are exposed to Acids, Alkalies, Coal Gas, etc. Thoroughly effective strong, and very durable.

We Invite Correspondence on the Subject.

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SOLE MANUFACTURERS.

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Chicago Office, 186 5th Avenue.
Cleveland, Ohio, - The A. T. Osborn Co.

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Edward Brown,

ESTABLISHED 1860.

311 WALNUT St., PHILADELPHIA.

Manufacturer and Patentee OF THE

Hot Blast (or Graphite) Pyrometer.—The only stationary Pyrometer now in use durable over 700 degrees.

The Standard Portable Pyrometer—For Blast Furnaces.

Mercury Revolution Indicator.—Centennial Exhibition Medal. Accurate for all time.

Annealing Oven Pyrometer—to 3,000 degrees—of 1893.

Tin-plating Pyrometer—of 1894.

Mercury and Steam Gauges.

EXPANSION BOLTS.

For Fastening all Kinds of Structure to Brick and Stone Work.

Patentee and M'f'r, **ISAAC CHURCH,**
Send for Catalogue. 1521 Walnut St., TOLEDO, O.

Semi-Steel Castings

34,000 TO 38,000 TENSILE STRENGTH.

Process Owned by

THE McDOWELL STEEL CO,

Room 902, Mallers Bldg., - - CHICAGO, ILL.

MINING HOISTS

—AND—

HOISTING ENGINES.

DERRICKS

American Hoist & Derrick Co.,
ST PAUL, MINN.

Chicago, 60 So. Canal St.
New York, Havemeyer Bldg
Cincinnati, Carew Bldg.

THE BETHLEHEM IRON CO.,

Principal Office and Works

SOUTH BETHLEHEM, PA.

STEEL RAILS.

BILLETS AND MUCK BAR,

STEEL FORGINGS.

HOLLOW SHAFTING, CRANKS, ROLLS, GUNS AND ARMOR.

Rough, Machined or Finished, Fluid Compressed, Hydraulic Forged.

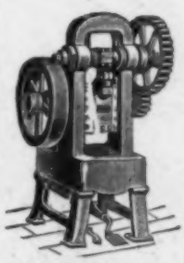
NEW YORK OFFICE, 100 BROADWAY. PHILADELPHIA OFFICE, 421 CHESTNUT ST.

CHICAGO OFFICE, MARQUETTE BUILDING.

THE TOLEDO MACHINE & TOOL CO.

501-505 Superior St., Toledo, Ohio.

We manufacture



No. 54 Power Press.

Power Punches, Forging Presses,
Power Presses, Trimming Presses,
Straight Sided Double Pitman Presses,
Drop Presses,
Embossing Presses, Automatic Feed Presses,
Stamping Presses, Power Slitting Machines,
Riveting Machines, Power Shears,

Special and Automatic Machinery Dies for all classes of work in sheet metals,
Write for catalogue and prices.

No. 75 Power Press.

THE "CLEARFIELD" FIRE BRICK

MANUFACTURED BY

THE CLEARFIELD FIRE BRICK CO., Limited,

Office and Works at CLEARFIELD, PA.

929 Liberty Street, Pittsburg, Pa., John Richardson, Agent.

CLEVELAND ROLLING MILL CO.,

CLEVELAND, - OHIO,

—MANUFACTURERS OF—

BESSEMER AND OPEN-HEARTH STEEL,

Blooms, Billets, and Slabs, Steel Rails, Steel Beams, Channels and Angles. Steel Forgings, Bar Spring, and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire, Iron and Steel Plates, Galvanized and Black Sheet Iron and Steel Corrugated Iron Roofing.

KING'S SIX TON ELECTRIC CRANE
Can be furnished at low cost.
Write for full information to the MARION STEAM SHOVEL CO Marion, Ohio.

FIRE BRICK

DOVER FIRE BRICK CO.,
MANUFACTURERS OF
Furnace, Mill and Special Shape Fire Brick.
Office, 44 Mercantile Bank Bldg.,
CLEVELAND, OHIO.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

THE CENTRAL IRON & STEEL CO.

BRAZIL, INDIANA,

MANUFACTURERS OF

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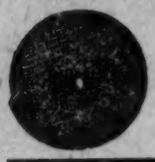

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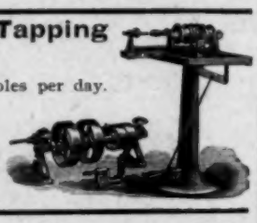

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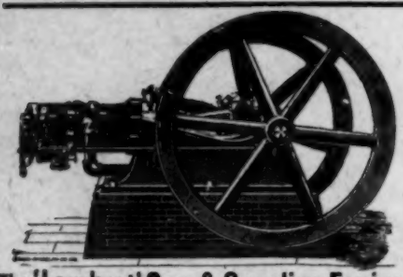

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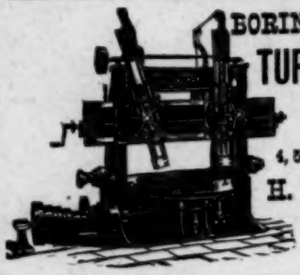

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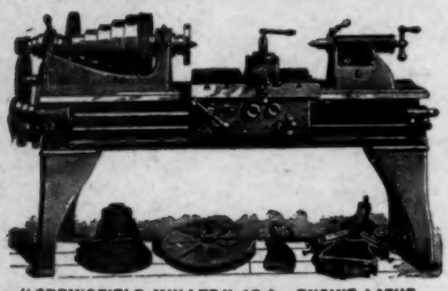

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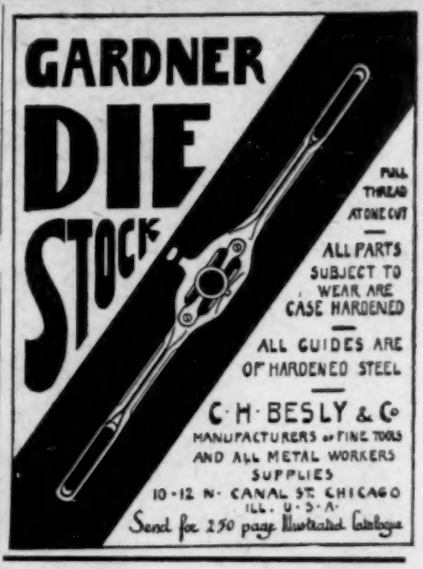
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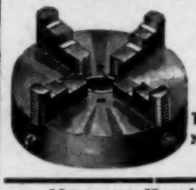

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